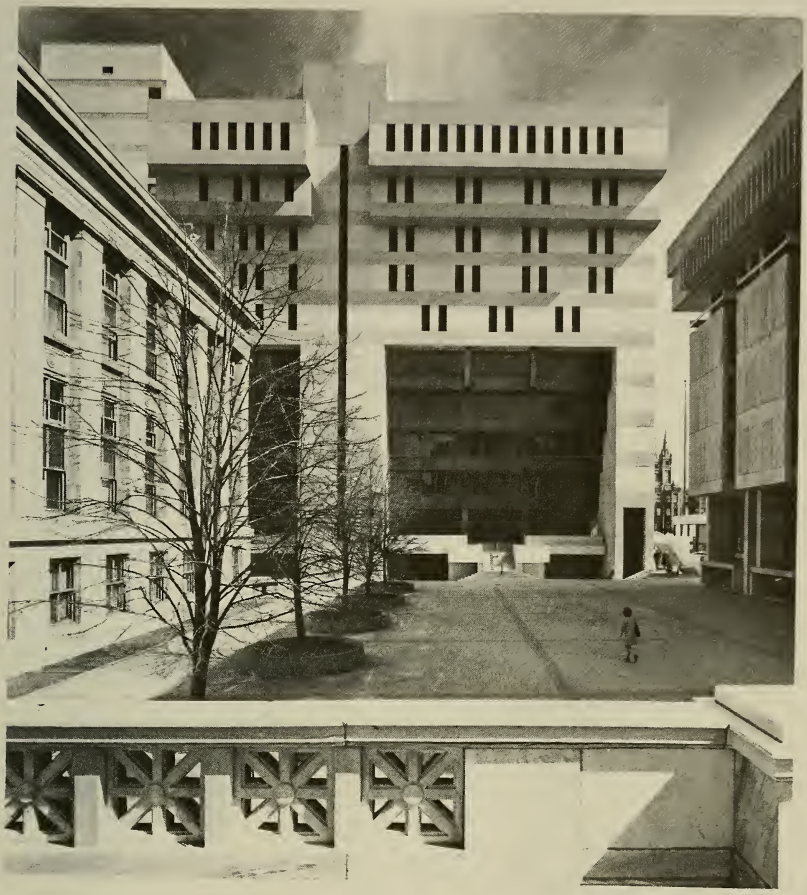
harvard school of public health

1977/1978

OFFICIAL REGISTER OF HARVARD UNIVERSITY
VOLUME 74, NUMBER 3/JULY 15, 1977



HARVARD SCHOOL OF PUBLIC HEALTH

Announcement of Courses
and General Information

1977-78

677 Huntington Avenue, Boston, Massachusetts 02115

OFFICIAL REGISTER OF HARVARD UNIVERSITY

These publications include the report of the president; the general catalog issue; the announcements of the College and the several professional schools of the University; the courses of instruction; the pamphlets of the several departments; and the like.

Every effort is made to insure that the information contained in this catalog is accurate at the time of publication. However, the School of Public Health reserves the right to make changes without notice in tuition and fees, admission and degree requirements, courses of instruction, and any other information contained herein.

As a matter of policy, Harvard University does not discriminate among applicants and students in admissions, educational policies, scholarship and loan programs, and athletic and other programs on the basis of race, religion, sex, national origin, color, handicap, or age.

Credit for photograph on title page: Balthazar Korab.

Printed in the United States of America by the Harvard University Printing Office.

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ACADEMIC CALENDAR, 1977-78

*September 12, Monday	Opening orientation session and preliminary registration for new international students
*September 13, Tuesday	Opening orientation session and preliminary registration for new U.S. students

Students previously enrolled may register any day during the week of September 12.

The period between the opening sessions and September 19 will be devoted to orientation lectures, individual conferences with faculty members, and selection of courses of study.

Fall Term, September 19, 1977, through January 20, 1978

September 19, Monday	First period courses begin
October 10, Monday	Columbus Day: a holiday
November 10, Thursday	First period ends
November 11, Friday	Veterans' Day: a holiday
November 14, Monday	Second period courses begin
November 24 and 25 Thursday and Friday	Thanksgiving recess

Recess from Wednesday, December 21, 1977, through Wednesday, January 4, 1978

January 9, Monday through January 13, Friday	Spring term registration period
January 20, Friday	Second period courses end
January 23, Monday through January 27, Friday	Supervised special studies or field observations

Spring Term, January 30, 1978, through June 8, 1978

January 30, Monday	Third period courses begin
February 20, Monday	Washington's Birthday: a holiday
March 24, Friday	Third period ends
March 27, Monday	Fourth period courses begin

*All students are required to attend the opening session and to be present for the registration period.

Recess from Sunday, April 2, 1978, through Sunday, April 9, 1978

May 26, Friday	Fourth period ends
May 29, Monday	Memorial Day: a holiday
May 30, Tuesday through June 7, Wednesday	Post-class period
June 8, Thursday	Commencement

ADMINISTRATION OF THE UNIVERSITY

President and Fellows of Harvard College

(This Board is commonly known as the Corporation.)

Derek Curtis Bok, A.B., J.D., A.M., LL.D., *President*
Francis Hardon Burr, A.B., LL.B., *Senior Fellow of Harvard College*
Hugh Calkins, A.B., LL.B., *Fellow of Harvard College*
John Morton Blum, A.B., A.M., Ph.D., *Fellow of Harvard College*
Charles Pence Slichter, A.B., A.M., Ph.D., *Fellow of Harvard College*
Robert Gregg Stone, Jr., A.B., *Fellow of Harvard College*
George Putnam, A.B., M.B.A., *Treasurer of Harvard College*
Robert Shenton, A.B., M.B.A., Ph.D., *Secretary to the Corporation*
Frances Mary Gabron, *Assistant Secretary to the Corporation*

ADMINISTRATION OF THE SCHOOL OF PUBLIC HEALTH

Administrative Officers

Derek Curtis Bok, A.B., J.D., A.M., LL.D., *President*
Howard Haym Hiatt, M.D., *Dean of the Faculty of Public Health*
James Laverre Whittenberger, S.B., M.D., A.M. (hon.), *Associate Dean of the Faculty of Public Health and Director of the Kresge Center for Environmental Health*
Joseph David Brain, A.B., S.M., S.M. in Hyg., S.D. in Hyg., *Acting Associate Dean for Academic Affairs*
Michael James Farmer, A.B., M.B.A., *Associate Dean for Policy and Resources*
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William Alonso, A.B., M.C.P., Ph.D., *Director of the Center for Population Studies*
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Jeannette Jane Simmons, S.B., M.P.H., S.D. in Hyg., *Assistant Dean for Students*
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Stephen Carl Joseph, A.B., M.D., M.P.H., *Director of the Office of International Health Programs*
H. Richard Nesson, A.B., M.D., *Director of the Office of Extramural Health Programs*
Howard Stanley Frazier, Ph.B., M.D., *Director of the Center for the Analysis of Health Practices*
Herbert Sherman, B.E.E., M.E.E., D.E.E., *Director of the Office of Program Planning*

Donald Frederick Hornig, S.B., Ph.D., *Director of Interdisciplinary Programs in Health*
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Roger Benham Spaulding, A.B., *Special Assistant to the Dean*
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Margaret Dale Penrose, A.B., A.M., *Assistant to the Dean and Director of Shattuck International House and Alumni Affairs*
Emily Kramer Morrison, S.B., *Assistant to the Dean*
Margaret Catherine Salmon, S.B., *Assistant to the Dean for Faculty Administration and Financial Aid Officer*
Eileen C. Shapiro, A.B., *Assistant to the Deans for Minorities and Women, Harvard Medical School, Harvard School of Dental Medicine, and Harvard School of Public Health*
Jay Andrew Winsten, A.B., Ph.D., *Assistant to the Dean*
Raymond Kenneth Neff, A.B., S.M. in Hyg., *Director of the Health Sciences Computing Facility*
James Joseph Feeney, A.B., M.D., *Director of the Medical Area Health Service*

Administrative Board

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James L. Whittenberger
Margaret C. Salmon, *Secretary*

The Harvard School of Public Health

The educational programs of the School of Public Health are directed primarily toward those whose careers are or will be concerned with improving the health of population groups through service, teaching, and/or research.

Public health as a profession evolved from the early combination of medical science and engineering for the control of environmental hazards. The field has grown to embrace applications of various facets of the natural, mathematical, and social sciences as community aspects of health problems have become more complex and demanding. Promotion of the public health now depends upon the skills and knowledge of members of several professions. The role of a graduate school of public health today is to prepare those who will be concerned with health problems which exceed the scope of any single discipline. Many of these problems can best be solved through the skillful cooperation of specialists from the fields of medicine, statistics, epidemiology, engineering, management, public policy, law, economics, sociology, chemistry, biology, and others.

HISTORY OF THE SCHOOL

Activity in professional education in the field of public health had been steadily increasing in Harvard University for more than two decades before the actual founding of the School in 1922. Its gradual development was characterized by certain important steps, the first of which was the establishment, in 1909, of the Department of Preventive Medicine and Hygiene in the Medical School — the first such department in the United States. The degree of Doctor of Public Health was first conferred in 1911. In that year a Department of Sanitary Engineering was established in the Graduate School of Engineering. In 1913, the Department of Tropical Medicine and, in 1918, the Division of Industrial Hygiene, with clinical and laboratory facilities, were organized in the Harvard Medical School.

Also in 1913, the Harvard–Massachusetts Institute of Technology School for Health Officers was formed under the joint management of Harvard University and the Massachusetts Institute of Technology. This School operated until the fall of 1922, when it was superseded by the Harvard School of Public Health, made possible by an endowment for this purpose from the Rockefeller Foundation.

In the early years of the School's operation, several of its departments functioned as joint departments with counterparts in the Medical School, sharing facilities, faculty, and budgets. In 1946, the School was separated administratively and financially from the Medical School and became an autonomous unit of Harvard University. It continues to cooperate with the Medical School in teaching and research, and has also developed close associations with other divisions of the University, particularly the Graduate School of Arts and Sciences, the John F. Kennedy School of Government, and the Graduate School of Business Administration.

OBJECTIVES OF THE SCHOOL

The objectives of the School are the advancement of knowledge and graduate education in the relevant disciplines and problem areas of public health. In its efforts to advance knowledge, the School is concerned with health problems of major importance to society, not only in technologically advanced regions, but also in economically disadvantaged areas.

The educational programs of the School offer instruction in the community-oriented health sciences and in the techniques of administration for able men and women who have potential for imaginative leadership. In addition to the education of physicians and other professionals, high priority is given to the postbaccalaureate preparation of young people for careers in the health system. The School also provides opportunities for graduate students in law, business, government, education, and other fields to prepare for application of their special skills to health problems. Finally, increased emphasis is being given to the development of short, nondegree programs for active health professionals seeking midcareer educational opportunities.

In its involvement in the contemporary health problems of society, the School collaborates with community leaders in seeking ways in which knowledge can be effectively used for the advancement of human health. The School has forged and is strengthening links with outside health facilities to provide settings for training and research analogous to those available to medical students and faculty in teaching hospitals. For example, faculty members are now helping to develop several comprehensive health care programs both here and in developing countries. These are designed not only to improve serv-

ices available to local populations, but also to serve as sites for education and research.

The School participates in both professional and graduate education and offers the degrees of Master and Doctor of Public Health, Master and Doctor of Science, and Master of Industrial Health.

LOCATION AND RESOURCES

The main buildings of the School are the Health Sciences Laboratories at 665 Huntington Avenue, and the Sebastian S. Kresge Educational Facilities Building at 677 Huntington Avenue, Boston. These buildings are near the Harvard Medical and Dental Schools; the Countway Library of Medicine; the Children's Hospital Medical Center; the Beth Israel, Peter Bent Brigham, and Women's Hospitals; and other Harvard-affiliated hospitals. The Center for Population Studies also has offices in Cambridge.

Health Sciences Computing Facility

Computing and data processing services are available to students through the Health Sciences Computing Facility (HSCF), which is operated by the School of Public Health. A staff of computer programmers and analysts assists researchers and students from all of the Harvard Medical Area institutions in using the computer as a tool for analyzing data, for doing extensive numerical calculations, and for acquiring, maintaining, and processing large data bases.

HSCF is equipped with unit record machines, including a counting card sorter and a variety of card punching machines. Remote batch processing computing is accomplished by a high-speed telephone link to the IBM 370/168 computer at the Massachusetts Institute of Technology. Interactive computing (time-sharing) capability is provided by low-speed terminals which are connected to several large computers in the New England area, notably the IBM 370/168 at the Massachusetts Institute of Technology and the Honeywell 66/40 at Dartmouth College.

HSCF is also equipped with two time-sharing computers, a PDP 11/70 and a PDP 11/34. The PDP 11/70 can accommodate up to thirty-two simultaneous users, has an industry-compatible magnetic tape unit, and uses the UNIX operating system. The PDP 11/34 uses the MIIS operating system, which is a commercially available version of the widely used MUMPS system. It can accommodate up to sixteen

simultaneous users and features a number of medical information programs, a "computerized" teaching program, and specialized medical and health data bases. Low-speed typewriter and video terminals are available in the School to allow students, faculty, and staff to have access to these computers.

HSCF staff members give a course in computing (Biostatistics 213b). There are also special tutorials (Biostatistics 313a,b,c,d) for interested students who have had prior computing experience. The Director of the HSCF is Mr. Raymond K. Neff.

Libraries

The library needs of the School are served principally by the Francis A. Countway Library of Medicine, located at 10 Shattuck Street. The Countway Library combines the resources and services of the Harvard Medical Library and the Boston Medical Library. Among libraries serving medical and health-related schools, it is the largest in the country, with recorded holdings of more than 460,000 volumes and 4,800 periodicals. The Countway Library also has extensive collections of historical materials, dating from the fifteenth century. Its history of medicine department provides modern facilities for the use of these books and other rarities.

All members of the University may borrow from the Harvard College library at Cambridge. Messenger service is provided daily between the college library, various other Harvard University libraries, and the Countway Library. The Boston Public Library, libraries of the Massachusetts Institute of Technology, and other libraries of the Boston area add to the total book and periodical resources available to students.

Other Resources

Students at the School may enroll in courses in other divisions of Harvard University, e.g., in the natural sciences, public administration, economics and other social sciences, statistics, and medical sciences. Certain graduate courses at the Massachusetts Institute of Technology are also open to students at the School. Students will generally be granted credit for such courses toward degrees being earned at the School of Public Health, with the exception of courses in foreign languages. Credit granted for cross-registered courses may not exceed one-half of the credit units required for the degree in question.

The School maintains a close association with a wide variety of health, medical care, and welfare organizations in Massachusetts and elsewhere. The facilities of hospitals and certain other institutions adjacent to the School are available to qualified students. Other local, national, and international health facilities provide opportunities for observation and special studies, and members of their staffs are available to assist in the School's educational program. The State Laboratory Institute of the Massachusetts Department of Public Health offers excellent opportunities for qualified students to obtain experience in laboratory methods pertinent to public health.

CENTERS AND OFFICES

Center for the Analysis of Health Practices

The School has established a Center for the Analysis of Health Practices in response to the increasingly recognized need for better analysis of diagnostic and therapeutic measures in current use or under development in the health fields.

The Center brings together professionals from various disciplines, including clinical medicine, statistics, law, ethics, epidemiology, economics, and public policy, to cooperate in such activities as:

1. Identification of clinical problems where current diagnostic or therapeutic modalities are of uncertain validity or merit;
2. Investigation of the effectiveness of health practices, including inquiry into the cost-benefit, public policy, ethical, and legal aspects of procedures that are in use or proposed for adoption;
3. Participation in the design and analysis of clinical trials, to be undertaken in teaching hospitals and elsewhere;
4. Training clinical investigators, statisticians, and others in the principles of clinical research.

The Director of the Center is Howard S. Frazier, M.D. The Clinical Director is Peter Braun, M.D.

Center for Community Health and Medical Care

The Center for Community Health and Medical Care was established under the joint auspices of the Harvard Medical School and the Harvard School of Public Health to serve as a focus for research and development in the organization, delivery, financing, and evaluation of health care.

The interdisciplinary staff and faculty members of the Center are concerned with the design of experimental programs as well as the study of existing arrangements, mechanisms, institutions, and related personnel involved in providing personal health services. Special emphasis is placed on evaluation and the refinement of evaluation methodology applicable to this field.

The program of the Center includes:

1. Research in the organization and delivery of health services;
2. Postdoctoral fellowship programs designed to prepare professionals with the capability to design, plan, manage, and evaluate the instrumentalities and the systems for the delivery of health services.

Through its involvement of several faculties of the University and through its programs for young physicians and other professionals, the Center provides a focus for the health activities of Harvard which are broadly directed toward the improvement of health services and medical care.

The Director of the Center is Paul M. Densen, S.D.

Center for Population Studies

The Center for Population Studies was established in 1964 under the leadership of the School of Public Health, as a University-wide Center to join scholars and scientists in different fields in a common approach to human population problems. The members and research associates of the Center are drawn from the Departments of Biology, Economics, Government, and Sociology; the Division of Applied Sciences; and the Schools of Public Health, Design, Education, Medicine, and Divinity. The Center is located at 9 Bow Street, Cambridge.

In the School of Public Health, the Department of Population Sciences welcomes qualified candidates for the various degrees offered by the School. Courses open to all qualified students are also given by members of the Center in the Department of General Education and in the other parts of the University listed above.

The present research programs of the Center and the Department focus on several themes: laboratory and clinical research programs in human reproductive biology; economic, social, and environmental determinants and consequences of population change in America

and other developed and developing countries, including public health aspects of fertility and the balance between populations and their resources; problems of urbanization and internal migration in both developed and developing countries; theories of population kinematics and dynamics and their implications for public policy; political and ethical aspects of population policy; historical population studies; population education; and adolescent growth and menarche.

The Director of the Center is William Alonso, M.C.P., Ph.D.

Center for the Prevention of Infectious Diseases

The Center for the Prevention of Infectious Diseases comprises the Departments of Microbiology and Tropical Public Health. Working in close collaboration, the staffs of the two Departments are concerned with the broad spectrum of agents, i.e., viral, rickettsial, chlamydial, bacterial, mycotic, protozoal, and helminthic entities, that parasitize man and with their relevant arthropod and molluscan vectors.

On a global basis the infectious diseases remain a primary cause of mortality. In the developed areas of the world, morbidity attributable to infectious diseases persists as a major impediment to the enjoyment of health. An increasing number of chronic degenerative diseases are recognized as stemming from the insults of prior infectious processes. In many societies, acceptance of the concept of population control awaits containment of undue mortality induced by the infectious diseases and the consequent assurance that children who are born will have a reasonable prospect of achieving maturity. Considerations such as the foregoing emphasize the continuing need for the public health expert to possess knowledge of the rapidly changing technology of the control of infectious diseases, as well as basic knowledge concerning the attributes and epidemiologic characteristics of the responsible agents.

The faculty of the Center for the Prevention of Infectious Diseases work together to discharge a common responsibility for multidisciplinary instruction in the various facets of diseases of infectious etiology. The formal course offerings of the two Departments are designed and scheduled to permit the acquisition of a broad basic knowledge of infectious diseases as well as an introduction to specialized subject areas. For qualified advanced students, concentration in specific areas with participation in collaborative or individual research is encouraged at both predoctoral and postdoctoral levels. The wide

variety of current research projects in the Center permits acquisition of experience both at home and abroad, in the laboratory or in the field. Training grant funds may be available for the support of qualified individuals specifically interested in the study of bacteriology, virology, mycology, parasitology, venereal disease, rickettsiae, chlamydiae, and tropical medicine in relation to public health.

The Director of the Center is Thomas H. Weller, M.D.; the Associate Director is Roger L. Nichols, M.D.

The Kresge Center for Environmental Health

This Center includes the Departments of Physiology, Sanitary Engineering, and Environmental Health Sciences. The Center serves as a focus for environmental health activities within the School of Public Health. Full-time faculty within the Center include physicians, engineers, physiologists, mathematicians, toxicologists, chemists, physicists, meteorologists, and other professionals. This diversity enables the staff to deal effectively with environmental problems which require a multidisciplinary approach.

Specific categories in which the Center conducts research and training include:

1. Air pollution effects and control
2. Environmental toxicology
3. Radiation biology
4. Medical radiological physics
5. Industrial hygiene
6. Occupational medicine
7. Radiological health (radiation protection)
8. Respiratory physiology
9. Sanitary engineering
10. Environmental health management

Degree programs include the Master of Public Health, Master of Science, Master of Industrial Health, Doctor of Science, and Doctor of Public Health. Formal requirements for each of these degrees are outlined in other sections of the catalog. Students interested in any of the above areas ordinarily enroll in the School of Public Health. Students whose primary interest is in problems of water quality and water resources generally enroll in the Division of Applied Sciences of the Graduate School of Arts and Sciences.

The Director of the Kresge Center is James L. Whittenberger, M.D. The Associate Director is Dade W. Moeller, Ph.D.

Office of Extramural Health Programs

The Office of Extramural Health Programs has established and is strengthening working relationships with components of the health system, including governmental agencies, providers of health services, and organizations of consumers. A principal objective is to provide training positions for students and research opportunities for faculty in operating health agencies and organizations outside the academic setting.

Working relationships with a wide spectrum of providers, payors, and regulators have developed into a unique blend of technical assistance, education, and research. The Office is currently involved in a major joint effort with the Peter Bent Brigham Hospital and the Affiliated Hospitals Center to develop an innovative service and training program in primary medical care and health services administration.

The Director of the Office is H. Richard Nesson, M.D.

Office of International Health Programs

The School provides opportunities for preparation for careers in teaching, research, and service in international health. Various programs available within the School, together with related course offerings in other divisions of Harvard University and the Massachusetts Institute of Technology, offer students a broad background for future careers with international agencies, mission groups, philanthropic foundations, and foreign governmental and academic institutions. Cross-registration opportunities are available for students interested in medicine, economics, public administration, education, anthropology, government, social relations, and related subjects appropriate to particular regions of the world. (Students may also cross-register for courses in foreign languages, but may not receive credit for such courses toward degrees being earned at the School.)

The poor health conditions characteristic of less developed areas are the primary focus for many of the teaching and research activities of the School. In conjunction with the Harvard Institute for International Development, the School is working toward a more comprehensive and coherent program for those whose primary responsibilities will be concerned with the health problems of developing countries, especially as these health problems interact with the prob-

lems of nutrition and rapid population growth and the larger questions of health and social and economic development.

Courses may be selected as part of programs leading to the Master of Public Health or Master of Science degrees. Students interested in the problems of health in developing countries may select a concentration in the General Program (of the M.P.H. program) or in one of the relevant departments.

The Director of the Office is Stephen C. Joseph, M.D., M.P.H.

CONTINUING EDUCATION

The School offers a variety of continuing education programs and short courses for existing health professionals. Most of these programs are offered through Executive Programs in Health Policy and Management (described below); short courses in various aspects of environmental health and other areas are also available.

Executive Programs in Health Policy and Management

Established in 1974, Executive Programs in Health Policy and Management is developing and presenting a series of continuing education programs in health management, policy, planning, and regulation for executives involved in health care. The program is based at the School of Public Health, and draws on other University resources, including the Graduate School of Arts and Sciences, the Harvard Business School, and the John F. Kennedy School of Government.

Most offerings are given for professionals in senior levels of responsibility in their organizations. Some programs are planned for those at middle-management levels. Organizational sponsorship is usually required.

Courses are offered in three major areas:

1. Management of health care systems and institutions
2. Health policy, planning, and regulation
3. Management and regulation of environmental health services

The program does not offer courses in the clinical aspects of medicine and public health.

The Director of Executive Programs in Health Policy and Management is Marc Roberts, Ph.D.

Admission and General Information for Students

APPLICATION FOR ADMISSION

Applicants must submit the following for consideration by the Committee on Admissions and Degrees: (1) completed application form; (2) transcripts of academic record at college, graduate school, and/or professional school; (3) names of at least three people, well acquainted with the applicant's previous work, from whom letters of recommendation have been requested. In addition, the Graduate Record Examination is required of certain applicants, as noted elsewhere in this catalog.

An application fee of $25, which is not refundable, is required for each formal application. A check drawn on a bank in the United States, a postal money order, or an international money order, payable to the Harvard School of Public Health, must accompany the application.

In addition to fulfilling the specific requirements for admission to a degree program, applicants must satisfy the Committee on Admissions and Degrees as to their ability to undertake advanced study at a graduate level. The final decision as to the admissibility of an applicant rests with the Committee.

The School is unable to accept all who are eligible for admission. Therefore, persons who wish to be considered for admission must submit their applications by *February first* prior to the academic year in which they wish to enroll. Spring term applications are not encouraged, because of the sequence of course offerings at the School. Candidates seeking admission in the spring term should first contact the department or program of interest to determine whether application for admission at that time is permissible.

Admission of a candidate is for a particular year; if enrollment at that time is not possible, reapplication is necessary and will be considered on the same competitive basis as a new application.

As a matter of policy, Harvard University does not discriminate among applicants and students in admissions, educational policies, scholarship and loan programs, and athletic and other programs on

the basis of race, religion, sex, national origin, color, handicap, or age. The School encourages women and members of minority groups to apply for admission.

International Students

Language Proficiency. Applicants from countries in which the language of instruction is not English must satisfy the Committee on Admissions and Degrees as to their ability to speak, read, write, and understand the English language competently. The applicant should have sufficient knowledge of English to enable him to understand lectures in English, to participate in seminar discussions, and to write examinations. In the absence of sufficient evidence from the sponsoring agency and other sources, the School will request that the applicant take and pass satisfactorily the Test of English as a Foreign Language. The test is administered four times a year at centers throughout the world. Applicants are advised to take this test as early as possible in the admissions process. Information concerning the test may be obtained by writing to the Test of English as a Foreign Language, Box 899, Princeton, New Jersey 08540. Certification of English proficiency must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued to the student.

Financial Certification. The School has adopted the following policy regarding foreign nationals who are applying for admission from outside the United States. An applicant whose financial support is not guaranteed by an official U.S. agency or foundation must submit evidence satisfactory to the School that he will have sufficient funds available in U.S. currency to enable him to pay his expenses for the full period of his academic program, and that he is permitted to exchange or export these funds. Certification of adequate financial resources must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued. Foreign students who are wholly supported by personal funds will be required to have adequate funds on deposit in a U.S. bank before the immigration form will be issued.

Foreign nationals admitted to the School and already residing within the United States will also be required to submit satisfactory evidence of sufficient funds to cover their expenses for the full period of their academic program. Such students will not be permitted to

register at the School unless certification of adequate financial resources has been received.

An estimate of living expenses in the Boston area may be found in the section entitled "Living Expenses" on page 24.

All inquiries and communications regarding admission should be addressed to the Director of Admissions, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

PART-TIME STUDENTS

(Degree Candidates)

Students may register as part-time degree candidates with the approval of the Committee on Admissions and Degrees. Ordinarily this requires half-time attendance. A one-year program may be completed in two academic years, a two-year program in three academic years. Ten credit units per term constitute a regular program for half-time students. Half-time students may register for no more than 12.5 credit units per term.

SPECIAL STUDENTS

Subject to availability of space, the School may accept a few students who are not degree candidates, but who are interested in taking one or more courses in a special field. Candidates should specify on the application form the courses they plan to take. Procedures and requirements for the admission of such students are the same as for degree candidates. Admission as a special student carries with it no commitment to accept the applicant as a degree candidate and is limited to one academic year. Special students who wish to be admitted to degree candidacy must reapply. They will be considered on the same basis as other applicants for admission.

CREDIT ASSIGNMENT

Credit units are assigned on the basis of the total amount of time required by a course, both in class and outside of class. Twenty credit units constitute a full program for one term. A full-time student may register for no more than 25 credit units per semester unless permission is obtained from the Committee on Admissions and Degrees.

TUITION AND FEES

The tuition fees for the academic year 1977-78 are listed below. These include the Health Service fee for medical care for all resident students enrolled for 6 or more credit units. (Hospital insurance, which is billed separately, is discussed later in this section.)

	1977-78
Full-time resident students	$4,300
Half-time resident students	2,335
All resident students pay tuition at the above rates with the following exceptions:	
Doctoral candidates or special students in the second or later years of a doctoral or special program:	
Full-time resident students	2,335
Half-time resident students	1,385
Nonresident doctoral candidates, registered *in absentia*	200
Part-time special students, enrolled for 6 or more credit units:	
First credit unit of work per term	260
Each additional unit per term up to 10 units	105
Part-time special students, enrolled for 5 or fewer credit units:	
First credit unit of work per term	175
Each additional unit per term up to 5 units	105
Summer session — effective July 1, 1978	
Students who register and receive credit for research or supervised study during 12-week summer period	575
Students registered for less than 12 weeks will pay at a proportionate rate.	

Hospital Insurance. A Blue Cross/Blue Shield student insurance plan provides coverage for many costs of medical care not offered at the University Health Services. All students are enrolled in this plan unless they have other adequate medical insurance and submit a waiver within two weeks following registration. Waivers are approved by the Director of the University Health Services. Coverage under the student insurance plan extends from September 1 through August 31. The premium for 1977-78 is $114.

Payment of Fees

Bills for tuition and fees will be issued and payable as follows:

Student term bill worksheets for the fall term will be issued on August 1, and will be payable *in full* by August 20.
Bills for the spring term will be issued in early January, and will be payable *in full* by January 25.

Payments may be scheduled over monthly installments (four each term) through an optional payment plan that is available at a service charge of $15 per term.

A student who leaves the School during the academic year is responsible for tuition charges in accordance with the following:

Leaves by		*Percent of Total*
First Term	*Second Term*	*Semester Charges*
October 25	February 25	25%
November 25	March 25	50%
December 24	April 25	75%

Students leaving after December 24 and April 25 of the first and second terms, respectively, are responsible for full tuition charges.

Students who are candidates for degrees must have paid all bills to the University at least one day before the day upon which the degrees are to be voted.

A student who leaves the University for any reason whatever must pay all charges against him immediately upon receipt of a bill from the Office of Fiscal Services. Every student is held responsible for the payment of fees until he has notified the Dean of his intention to withdraw from the School.

All term bills are sent to the student at his local address unless the Office of Fiscal Services is requested in writing to send them elsewhere.

Any student whose indebtedness to the University remains unpaid on the date fixed for payment is deprived of the privileges of the University. Reinstatement is obtained only by consent of the Dean of the School in which the student is enrolled after payment of all indebtedness and a reinstatement fee of $10. As a further condition of reinstatement, the student is required to file with the Office of Fiscal Services a bond in the amount of $1000 as security for the payment of future term bills.

Field Studies

Field opportunities, listed under each department's course offerings and bearing the course number 330, often entail travel expenses that must be met by the student. Information about estimated expenses should be obtained from the appropriate department.

LIVING EXPENSES

Living costs in the Boston area are higher than in most areas from which students come. The following are *minimum* amounts estimated that students will need in order to cover expenses for approximately nine months.

A single person will need at least $9,100, in addition to travel expenses, to cover the cost of tuition and health insurance ($4,414), rent ($2,700), and other living expenses ($1,986).

A family of four will need at least $15,000, in addition to travel expenses, to cover the cost of tuition and health insurance ($4,414), rent ($3,500), and other living expenses ($7,086), including medical care.

FELLOWSHIPS AND LOANS

The Harvard School of Public Health is a participant in the Harvard University Federally Insured Student Loan Program. This program permits a student who either is a U.S. citizen or has immigrant status to borrow up to $5,000 a year, providing the student has less than $15,000 in outstanding loans.

Some fellowship support is available through departments and special programs from federal and nonfederal sources for qualified students in a variety of fields.

As a matter of policy, the Harvard School of Public Health does not discriminate among applicants and students in fellowship and loan programs on the basis of race, religion, sex, national origin, color, handicap, or age.

Detailed information about fellowships and loans can be obtained by writing to Ms. Margaret C. Salmon, Financial Aid Officer, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

HOUSING

The Henry Lee Shattuck International House is an apartment residence operated on a nonprofit basis by the School for its full-time students and their families from the United States and abroad. Located at 199, 203, and 207 Park Drive, within walking distance from the School, the House consists of sixty-five individual apartments, each with its own kitchenette and bath.

All apartments are rented furnished with basic items except for linens, blankets, and kitchen utensils, and are leased for the academic year, September 1 through June 30. No unfurnished units are provided. Special arrangements can be made for July and August. The monthly rent charge includes all utilities — hot water, heat, gas, and electricity — but not telephone service.

Applications should be submitted by May 15, although late applications will be considered as long as space is available. For application forms and more detailed information, write to Mrs. Margaret D. Penrose, Director, Shattuck International House, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

In addition to its other services, the School's Office of Student Affairs maintains an up-to-date list of real estate agencies in Boston and the surrounding areas.

The Harvard University Housing Office in Cambridge arranges for housing in University-owned complexes. Information and application forms may be obtained by writing to the Harvard University Housing Office, 7 Ware Street, Cambridge, Massachusetts 02138. A copy of the student's letter of acceptance from the School should be enclosed to prove affiliation. This Office also maintains listings of apartments and houses not owned by the University. These listings must be viewed in person; information is not given out by mail or telephone.

STUDENT HEALTH SERVICE

Under the University Health and Insurance Plan, students at the School of Public Health receive medical care and insurance toward hospital expenses. Medical care is provided through the facilities of the Medical Area Health Service, located in Vanderbilt Hall. The hospitalization insurance extends for a period of twelve months from September 1, and covers hospitalization in Boston and elsewhere. Research and teaching fellows who are in a training status are required to enroll in the Student Health Plan unless they can show that they have comparable coverage.

A prepaid program for the care of spouses (including maternity benefits) and children of full-time students is available. As the plan provides extensive benefits for ambulatory and inpatient care, all who are eligible are strongly advised to enroll. Its coverage, like that of the Student Plan, extends for a period of twelve months from September 1, and provides full semiprivate hospitalization benefits. A descriptive brochure about the plan for dependents is sent to students before registration or may be obtained from the Registrar.

Any illness necessitating absence from classes should be reported to the Medical Area Health Service Office by the student or an attending physician, and to the Registrar's Office at the School. A physician from the Medical Area Health Service, on call twenty-four hours a day, can be reached through the switchboard of Harvard University.

For further information, contact the Director, Medical Area Health Service, 275 Longwood Avenue, Boston, Massachusetts 02115. (Telephone: (617) 732-1370).

OFFICE OF STUDENT AFFAIRS

The Office of Student Affairs is concerned with many aspects of student life. The staff works with other groups and individuals to identify the special needs of students, plan orientation, publish the student directory, and arrange for student-faculty discussions and social events. Minority student recruitment activities are coordinated by staff in this Office. Up-to-date information is maintained about real estate agencies, child-care facilities, transportation, and athletic outlets in the Medical Area, elsewhere in Boston, and in Cambridge.

The Office administers a Student Placement Resource Center where reference material, position opportunity notebooks, and a list of alumni contacts are provided. The Office contacts potential employers to acquaint them with programs at the School and to request information about job openings. Current positions (permanent, summer, and part-time) are posted. Students are assisted in writing resumes, arranging for interviews, and exploring career opportunities. The Office's activities complement the efforts of departments, programs, and faculty advisers. Data collected about positions and salaries of graduates are available to prospective students.

Further information can be obtained from Dr. Jeannette Simmons, Assistant Dean for Students, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

Admission and Degree Requirements and Academic Programs

The School of Public Health offers programs leading to the graduate degrees of *Master of Public Health* (M.P.H.), *Doctor of Public Health* (Dr.P.H.), *Master of Industrial Health* (M.I.H.), *Master of Science* in a specified field (S.M. in . . .), and *Doctor of Science* in a specified field (S.D. in . . .). The general degree requirements and the respective requirements for admission are discussed in the following sections.

MASTER OF PUBLIC HEALTH

The program leading to the Master of Public Health degree consists of one academic year of study designed to prepare existing health professionals for careers in public health practice. The program provides a broad background in various disciplines basic to public health. Through the choice of elective courses beyond the basic area requirements, students may acquire a general knowledge of several areas or may pursue in some depth one or more areas of particular relevance to their career goals.

Requirements for Admission

Applicants to the M.P.H. program must satisfy the Committee on Admissions and Degrees as to their academic ability, the relevance of their previous education and experience, and their overall qualifications for graduate professional education in public health. Ordinarily, an applicant should hold a doctoral degree in medicine, dentistry, or veterinary medicine. Consideration is also given to applicants who hold doctoral degrees in biology, behavioral sciences, other natural sciences and social sciences, law, economics, engineering, and certain related fields regarded by the School as appropriate background for entrance into the public health profession.

Students currently enrolled in an M.D. or D.M.D. program may apply for admission to the M.P.H. program — if a joint program can be arranged that meets the approval of both the Committee on Admissions and Degrees and the institution from which the doctoral degree

is being earned. Ordinarily, such students are concurrently enrolled at the Harvard Medical School or the Harvard School of Dental Medicine, but occasionally students from other schools of medicine or dentistry are able to arrange similar programs. For students in a joint degree program, the M.P.H. degree will be conferred in the term in which the doctoral degree is awarded.

In very exceptional instances, consideration for admission to the M.P.H. program may be given to an applicant who holds a master's degree, or, more rarely, a baccalaureate degree, with a highly distinguished academic record, coupled with substantial professional experience in public health or related fields. These applicants must be able to demonstrate sufficient knowledge and competence to satisfy the Committee on Admissions and Degrees as to their qualifications for professional public health education and may be required to submit scores for the Aptitude Test of the Graduate Record Examination.

Requirements for the Degree

An M.P.H. degree candidate must spend one academic year in residence at the University and must successfully complete courses totaling a minimum of 40 credit units, at least half of which must be earned at the Harvard School of Public Health. Each M.P.H. student's program must include courses that represent adequate coverage in three basic areas of public health, as outlined below. The extent of coverage in these areas must meet the approval of the Master of Public Health Program Committee.

In a given student's program, no single course shall satisfy the requirement in more than one of the following areas:

1. Fundamental knowledge and concepts about man, with particular attention to his interaction with the (1) physical, (2) biological, and (3) social (including psychological) environment, and the effects of that interaction on his health. *Study programs will ordinarily include introductory courses in at least two of these three subareas.*
2. Basic techniques of investigation, measurement, and evaluation, with emphasis on their use in understanding health in human communities. *Study programs will ordinarily include the introductory courses in biostatistics and epidemiology.*
3. Basic approaches to policy planning and program management

and their application to the promotion of community health within the social, economic, and political setting relevant to health services. *Study programs will ordinarily include one of the introductory courses in health services administration.*

DOCTOR OF PUBLIC HEALTH

The Doctor of Public Health is an advanced professional degree for those who intend to pursue academic or research careers in public health, including administrative, planning, or evaluation roles in public health practice. The degree is granted on successful completion of an approved program of independent and original investigation in a special field of public health and the presentation of the results of this research in an acceptable thesis.

Requirements for Admission

An applicant for admission to candidacy for the Doctor of Public Health degree normally must be a graduate of an approved school of medicine, dental medicine, or veterinary medicine. Depending on the intended field of specialization, consideration may also be given to a candidate who holds an advanced degree in one of the disciplines basic to public health. In addition, the applicant must hold, or be in progress toward, the degree of Master of Public Health, or its equivalent, from an approved institution.

Applicants must be able to satisfy the Committee on Admissions and Degrees as to their overall qualifications for doctoral study at the School and must demonstrate potential ability to undertake original investigation in a special field. Scores for the Aptitude Test of the Graduate Record Examination must be submitted by all applicants except those with previously earned doctoral degrees and those who have received or are in progress toward a master's degree from the Harvard School of Public Health.

Admission to doctoral candidacy is considered provisional until the candidate has passed both parts of the qualifying examination.

Requirements for the Degree

Doctoral candidates are required to complete a minimum of one academic year in residence at the University while enrolled in the doctoral program. However, the required work and preparation of an acceptable thesis normally require at least two full years and frequently longer.

Residence requirements are fulfilled by payment of tuition and pursuit of an approved program. It should be noted that the required year of residence for the doctoral degree is in addition to residence requirements for a master's degree from the School. That is, a year of residence while working toward a master's degree does not fulfill the residence requirement for the doctoral degree.

The first year of doctoral study is almost invariably spent in actual residence at the School. Thereafter, the thesis work may be continued at the School or, in special circumstances, may be done *in absentia*, under arrangements described farther on.

After the student is enrolled as a provisional doctoral candidate, a doctoral program adviser is appointed by the department or field of concentration. The adviser keeps the student informed of all procedures and requirements for the degree; advises him about proper courses to be taken; decides, together with the department, when the student is prepared to take the qualifying examination; and supervises the thesis work.

Qualifying Examination. The qualifying examination for admission to full doctoral candidacy consists of two parts, A and B. Part A may be written, oral, or both. It is administered by the department of concentration and consists of a thorough examination in the field of concentration and in closely related areas.

On satisfactory completion of Part A, the candidate is eligible for Part B. This second part of the qualifying examination is an oral examination in the field of concentration and in at least two other relevant fields. Management of Part B is the responsibility of the Committee on Admissions and Degrees and the Registrar.

Both parts of the qualifying examination should normally be completed within one year of registration as a provisional doctoral candidate.

Doctoral Evaluation Committee. After the candidate has passed the qualifying examination, two faculty members are appointed to aid the adviser in the periodic evaluation of the student's progress.

Thesis. An acceptable thesis must be submitted within five years of the date of registration as a provisional doctoral candidate. The thesis should consist of one or more manuscripts suitable for publication in a scientific medium appropriate to the candidate's field. If the work is published prior to submission of the thesis, reprints may be submitted in lieu of manuscript.

The thesis must first be accepted by the department of concentra-

tion. When it is, three unbound copies should be deposited in the Registrar's Office. On request of the department, the Committee on Admissions and Degrees will appoint three or more readers. When the readers have individually evaluated the thesis, they will meet, together with one or more members of the Committee, and make a joint recommendation regarding acceptance of the thesis. The readers, as individuals or at their meeting, may call on the student for clarification, augmentation, or defense of material presented in the thesis.

If the thesis is accepted, the Committee on Admissions and Degrees may then recommend the candidate to the Faculty for the degree. The degree is voted by the Faculty at its special meetings in October, February, or June.

The unbound copies of the thesis must be in the Registrar's Office before *September first* for degrees to be awarded in November, before *January first* for degrees to be awarded at midyear, and before *April fifteenth* for degrees to be awarded in June. In order to meet these deadlines, the candidate should submit the completed thesis to his department for approval at least two weeks in advance of these dates.

Thesis Work in Absentia. For thesis work done *in absentia*, the adviser and the appointed evaluators must meet with the candidate to appraise the thesis plan. Agreement must be reached and the Committee on Admissions and Degrees must be advised in writing before departure of the student as to: (1) the acceptability and feasibility of the proposed thesis plan; (2) the timing and scope of periodic written reports which will be required of the student; (3) arrangements which have been or can be made for direct field supervision of the student; and (4) the minimum period of time the student will spend at the School before submitting his thesis for appraisal by the readers (a minimum of four months is generally recommended).

Final Seminar. There is no formal public thesis defense. However, after acceptance of the thesis by the committee of readers, the department of concentration is responsible for the arrangement of a seminar at which the candidate will present and discuss his thesis work. These seminars are announced throughout the School, and are open to faculty, research staff, and students.

Additional information on doctoral program requirements may be obtained from the Registrar's Office.

MASTER OF INDUSTRIAL HEALTH

The program leading to the Master of Industrial Health degree is designed to provide physicians with postgraduate training in the public health disciplines that are relevant to the development of preventive medical programs in industry. This one-year degree program may be taken as part of a two-year approved residency in occupational medicine, or it may be taken as an independent one-year program.

Requirements for Admission

Candidates must be graduates of an approved school of medicine and must satisfy the Committee on Admissions and Degrees as to their scholastic ability to study at the graduate level. Students from the United States must have completed an internship or residency of at least twelve months in a hospital approved by the American Medical Association.

Requirements for the Degree

Candidates for the M.I.H. degree must spend one academic year in residence at the University and must successfully complete a program of at least 40 credit units, comprising both required and elective courses.

All candidates are expected to take the following courses unless they can demonstrate equivalent preparation:

Course	*Credit Units*
Principles of Biostatistics (Biostatistics 101a,b)	3.5
Principles of Epidemiology (Epidemiology 201a)	2.5
Principles of Environmental Health (Environmental Health Interdepartmental 201a,201b)	5
Introduction to Radiation Protection (Environmental Health Sciences 271a,b)	5

Basic Problems in Occupational Health and Industrial Environments (Environmental Health Sciences 251c,d)	5
Total:	21

Additional courses may be selected from the curriculum approved for residencies in occupational medicine.

MASTER OF SCIENCE IN SPECIFIED FIELD

The School offers one-year and two-year programs leading to the degree of Master of Science in designated fields of concentration. In general, these programs are designed for students with interests in the scientific basis of public health and preventive medicine. These degrees are granted upon fulfillment of a program of advanced work in one of the public health disciplines represented by departments and certain programs in the School. The Master of Science degrees currently conferred by the School include:

Master of Science in Behavioral Sciences
Master of Science in Biostatistics
Master of Science in Environmental Health Sciences
Master of Science in Epidemiology
Master of Science in Health Policy and Management
Master of Science in Health Services Administration
Master of Science in Maternal and Child Health
Master of Science in Microbiology
Master of Science in Nutrition
Master of Science in Physiology
Master of Science in Population Sciences
Master of Science in Tropical Public Health

Occasionally, students may be admitted to a program in which more than one of the above disciplines are combined in such a fashion as to meet the requirements of the programs or departments involved. In such instances, the degree conferred specifies the areas.

The above degrees are conferred upon completion of either a one-year or a two-year program, depending upon requirements of the respective programs. Programs leading to these degrees are described later in this section, following the general statement of admission and degree requirements. Requests for additional information

about specific programs should be directed to the respective departments, as indicated in the degree designation.

Requirements for Admission

Applicants to Master of Science degree programs must satisfy the Committee on Admissions and Degrees as to their overall qualifications and promise for successful graduate study at the School. Applicants must also satisfy the department or program to which admission is sought that they have an adequate academic and/or professional background appropriate for specialization in that field.

Conditions of eligibility for one-year or two-year programs vary with the area or department in which a student wishes to specialize. Prospective applicants should consult program descriptions for more specific information.

Generally, eligibility for admission to a one-year program is limited to graduates of approved schools of medicine, dentistry, or veterinary medicine, or to applicants who have earned doctoral or, for some programs, master's degrees in fields acceptable to the department(s) to which admission is sought. Applicants holding master's degrees may be considered for admission to one-year or to two-year programs, depending upon their prior educational and professional background and upon the particular requirements of the program to which they wish to apply.

An applicant holding a baccalaureate degree is normally considered for admission to a two-year program, in order to complete the requirements for a Master of Science degree. For a few programs, including industrial hygiene, air pollution control, and radiological health, applicants may be considered for a one-year program if they hold a bachelor's degree with adequate scientific and engineering training and if they have had at least two years of relevant professional experience in the field of specialization.

Occasionally, a year or more of appropriate graduate work in an approved institution may enable a student to fulfill two-year program requirements in one year. In some cases, however, program requirements are such that a student must spend one-and-a-half or two years in residence in order to complete the necessary courses, regardless of his prior training and experience.

Graduate Record Examination. All candidates for admission to a Master of Science program are required to submit scores for the Aptitude Test of the Graduate Record Examination unless they have

previously earned doctoral degrees. An Advanced Test of the Graduate Record Examination may be required in some programs if the applicant's undergraduate major is in one of the following fields: biology, chemistry, economics, engineering, mathematics, physics, political science, psychology, or sociology. Applicants are advised to take the Graduate Record Examination no later than the January test administration date. Additional information concerning the Graduate Record Examination requirement is included in the instructions accompanying the application form.

Requirements for the Degree

Students admitted to a one-year program must spend a minimum of one academic year in residence at the University and must successfully complete a program of at least 40 credit units. Students admitted to a two-year program must spend two academic years in residence and must successfully complete a program of at least 80 credit units.

While specific course requirements vary from program to program, all candidates for a Master of Science degree are required to take Biostatistics 101a,b and Epidemiology 201a, unless they can demonstrate equivalent preparation. Candidates who do not have a background in medicine or biology are advised to take Physiology 203a,b, or its equivalent, or a course in general biology elsewhere. Beyond these minimal course requirements, each program may specify additional courses that are necessary for satisfactory fulfillment of degree requirements in the particular area of specialization. These specific course requirements are generally *not* listed in this catalog. The student should consult with his adviser or department or program head about these requirements before deciding which courses to take.

Additional information about Master of Science programs in particular areas is included in the following program descriptions.

Master of Science in Behavioral Sciences

Two programs lead to the degree of *Master of Science in Behavioral Sciences.* The first is a general concentration in the behavioral sciences geared to the individual interests of students. The second program is designed to prepare physicians in the techniques of psychiatric epidemiology.

One-Year Program in Behavioral Sciences. The goal of this pro-

gram is to develop skills in applied behavioral sciences — e.g., medical sociology, psychosomatic medicine, methodology in behavioral techniques such as small-group processes — for use in administration and planning of health programs. The program is regarded as a terminal master's degree program for the majority of students, most of whom assume nonresearch administrative positions upon receipt of the S.M. degree.

Preferred candidates for admission to the program are physicians or persons with a minimum of a master's degree in the biological or social sciences. The curriculum is flexible, with wide latitude for individual differences in the selection of courses and overall program design, although the majority of courses are elected from the offerings of the Department of Behavioral Sciences.

Psychiatric Epidemiology. The goals of this program are: (1) to train students in the methods of psychiatric epidemiology for use in basic and applied research, and (2) to develop the conceptual skills of mental health administrators in using psychiatric epidemiology in program planning, delivery, and evaluation of services. It is a one-year S.M. program, terminal for most graduates, of whom roughly half assume positions involving research and/or evaluation of programs, and half become involved in the administration of mental health services.

Candidates preferred for admission to the program hold M.D. degrees (preferably with a residency in psychiatry) or Ph.D. degrees in psychology, anthropology, or perhaps a related social science. Occasionally, students with master's degrees in psychology or anthropology are accepted into the program.

Master of Science in Biostatistics

The program leading to the degree of *Master of Science in Biostatistics* is primarily a two-year curriculum geared to students with a prior bachelor's degree who have extensive training in mathematics. Occasionally students with a prior year of graduate work enroll and are able to complete the program in one year.

The goal of the program is to prepare students for doctoral-level study for careers in biostatistical research and teaching. Applicants are screened for their potential for doctoral study, and most continue toward the doctorate.

Approximately half of each student's program consists of courses in statistics and epidemiology at the School of Public Health and at

the Graduate School of Arts and Sciences. Other courses elected vary with the particular needs and background of individual students, although students are often advised to take general courses in human physiology, human biology, and, occasionally, courses in pathology and immunology. By the second year of the program, the student develops specific interests and elects, under advisement, more intensive courses related to his particular areas of interest.

For students not immediately interested in a doctoral program, the Department of Biostatistics offers a two-year terminal S.M. degree. This may be combined with a program in another department. Both departments would be involved in the admission process and the development of suitable programs.

Master of Science in Environmental Health Sciences

There are five specialized programs leading to the degree of *Master of Science in Environmental Health Sciences.* Although an occasional student is admitted to a general program in environmental health sciences, for which courses may be planned to suit individual student interests and career goals, the majority of students elect one of the specialties described below.

Problem analyses and the evaluation and reporting of such analyses are expected to be major components of the work of health professionals who graduate from these programs. To assure the development of these skills, each student accepted into a two-year master's program will be required to conduct an appropriate research or related study and to present a written report on it at an acceptable professional level. Such studies and the associated reports will generally be completed during the second year of the program. The minimum time devoted to this effort will be 5 credit units per semester, for a total of 10 credit units.

Air Pollution Control. This program provides preparation in the sciences basic to understanding air pollution research and control activities. The curriculum generally includes courses in community air pollution, meteorological aspects of air pollution, identification and measurement of air contaminants, air and gas cleaning, aerosol technology, and principles of toxicology. Upon receipt of the S.M. degree, most graduates secure positions with federal, state, or local regulatory agencies, with consulting firms, or with industry.

Acceptable candidates for the program normally have a bachelor's degree in engineering (preferably chemical engineering), chemistry,

mathematics, or physics. Although this is primarily a two-year program, students with master's degrees in the forenamed disciplines, and some students with prior training or experience in related areas, may be able to complete the program in one year.

Environmental Health Management. The principal goal of this program is to train professional public health personnel to manage environmental health problems, particularly in urban areas. The program is multidisciplinary and draws upon courses offered by the Harvard School of Public Health, by other faculties of Harvard University, and by the Massachusetts Institute of Technology. In addition to the basic course in environmental health management, students normally take a series of courses in air pollution control, industrial hygiene, radiological health (specialty areas offered through the Department of Environmental Health Sciences), or water pollution control (offered through the Division of Applied Sciences of the Graduate School of Arts and Sciences), supplemented by course work in environmental economics, public health administration, political and social sciences, environmental law, environmental planning, and health education.

The program is usually two years in length and includes a mandatory field training assignment with an environmental health agency during the intervening summer. Students admitted to the program normally hold a bachelor's degree in biology, engineering, geology, or another science. Most S.M. degree recipients enter nonresearch positions in the environmental control field.

Industrial Hygiene. The program in industrial hygiene is designed to help meet the demand for professional personnel with the skills and scientific knowledge that are needed to identify and control health problems — e.g., air contamination, noise, radiation, heat, pressure — that exist in the workplace. The curriculum generally includes recommended and/or required courses dealing with basic problems in occupational health and industrial environments, environmental control, identification and measurement of air contaminants, air and gas cleaning, principles of toxicology, and aerosol technology.

Acceptable candidates for the program normally have a bachelor's degree in engineering, chemistry, physics, or biology. Although this is primarily a two-year program, students with master's degrees in the above disciplines and some students with prior training or experience in related areas may be able to complete the program in one year.

Medical Radiological Physics. This program is designed to provide students with a large portion of the knowledge and experience necessary for the practice of radiological physics in a hospital and for certification by the American Board of Radiology. It is primarily a two-year program, after which many students continue toward a doctorate. Approximately half of the graduates of this program enter research careers; the remainder enter nonresearch careers, principally as radiological physicists in health-care settings. Program trainees normally have prior bachelor's or master's degrees in physics and mathematics.

The program utilizes the resources of the Harvard teaching hospitals and was designed in collaboration with the recently established Harvard-M.I.T. Program in Health Sciences and Technology. The curriculum draws upon courses within that program as well as courses offered within the Harvard School of Public Health. A typical curriculum might include recommended and/or required courses in radiation protection, radiation biology, X-ray protection, and physics in diagnostic radiology, nuclear medicine, and radiation therapy.

Radiological Health (Radiation Protection). Students in this program are provided with knowledge of the fundamentals of radiation protection. Considerable attention is given to the effects of environmental releases of radioactive materials, and the associated requirements for complying with regulations and standards. The curriculum includes recommended and/or required courses covering radiation protection, radiation biology, X-ray protection, aerosol technology, and radiation dosimetry.

Recipients of the S.M. degree are prepared for positions with the nuclear power industry, hospitals, universities, research institutions, governmental regulatory agencies, and consulting architectural or engineering firms. Students admitted typically have prior bachelor's or master's degrees in physics, mathematics, or engineering. The program normally requires two years, although some students with prior training and/or experience in relevant areas may complete the program in one year.

Master of Science in Epidemiology

Two programs lead to the degree of *Master of Science in Epidemiology.* A one-year program is offered for physicians, veterinarians, dentists, and students with prior master's degrees in a relevant field. The second program is a recently established two-year program

designed to prepare recent undergraduates who have strong backgrounds in biology and mathematics for careers in epidemiologic research.

One-Year Program. The one-year program is intended to provide students (primarily physicians) with basic skills in epidemiologic and quantitative methods and in computing, in preparation for research careers. The program usually includes most of the courses offered by the Department of Epidemiology, plus courses in principles of biostatistics, statistical methods in research, and computing principles and methods which are offered by the Department of Biostatistics (a total of 25 to 30 credit units). Additional formal courses in areas of special interest and/or supervised research comprise the remainder of the program. Approximately half of the S.M. degree recipients continue toward the doctorate, while others enter research work.

Two-Year Program. The two-year program is designed for persons who hold a bachelor's degree and have a strong background in biology and mathematics. In addition to the epidemiology and statistics courses listed under the one-year program, students take courses in basic medical sciences and the biological aspects of public health problems. The program is intended for students who will continue toward a doctorate.

Master of Science in Health Policy and Management

The program leading to the degree of *Master of Science in Health Policy and Management* is an interdisciplinary, two-year program which prepares students for careers in health planning and regulation or in the administration of health programs and institutions. Students holding baccalaureate degrees with strong academic backgrounds in the natural or social sciences are eligible to apply. The program encourages application from candidates with prior training as health professionals and/or some work experience in the health field. All applicants must demonstrate ability to master the quantitative and analytical content of the program.

A set of core courses comprises less than half of each student's program. These courses cover basic health issues and institutions, quantitative methods, epidemiology, economics of health policies and programs, and sociological and historical perspectives on health care. (Descriptions of these courses may by found under "Department of Epidemiology," "Interdepartmental Courses," and "Department of Health Services.") Beyond the core courses, students may

concentrate their studies in one of three ways: on policy skills; on management skills; or on a substantive health problem area, examining both planning and administrative aspects of that area. In addition to courses at the School of Public Health, students may select appropriate courses offered by other faculties at Harvard and by the Massachusetts Institute of Technology. Supervised field work (in the summer between years one and two and in the second year) is an integral part of the program. Students are exempted from required courses where they can demonstrate prior proficiency and, in exceptional circumstances, the period of study required for the degree may be reduced.

Master of Science in Health Services Administration

A one-year program is currently offered which leads to the degree of *Master of Science in Health Services Administration*. Its goal is to give students a broad understanding of the health services system while developing their abilities to address issues and problems analytically and to carry out rational approaches to problem solving.

Students admitted to the program generally hold medical degrees or master's degrees in disciplines related to health or administration, and preferably have had relevant work experience. Approximately two-thirds of the S.M. program graduates enter administrative positions, while others continue toward a doctorate. (Students without a previous advanced degree in a health field should apply for the two-year program in health policy and management described above.)

The curriculum is designed with sufficient flexibility to permit a student to direct his or her program toward particular health areas. Courses offered by the division of health services administration of the Department of Health Services normally constitute a substantial portion of each student's program.

Master of Science in Maternal and Child Health

The program leading to the degree of *Master of Science in Maternal and Child Health* is primarily a one-year program for students with prior master's degrees in nursing, social work, or nutrition, or M.D. degrees, preferably with professional experience in a public health agency or health-care program, or research experience in child growth and development. The program provides knowledge of the principles of administration of health services for mothers and children, and skills for determining needs, designing services, and plan-

ning health programs for mothers and children and for other special groups (e.g., handicapped persons).

Most S.M. degree recipients enter nonresearch administrative positions, and some continue toward a doctorate. Most students elect basic courses offered by the divisions of maternal and child health and health services administration of the Department of Health Services. However, the curriculum is flexible, with latitude for course selection tailored to individual interests.

Master of Science in Microbiology

Programs leading to the degree of *Master of Science in Microbiology* are offered in the following areas: cancer biology; immunology; management of communicable disease laboratories; medical mycology and immunology; rickettsiae and chlamydiae; and virology. Unless otherwise indicated, these programs are designed for students who intend to continue toward the doctoral degree. Applicants will be selected on the basis of their interest in, and potential for, continuation in doctoral study. For admission, a minimum of a bachelor's degree in microbiology, biochemistry, cell biology, and/or other related areas is required. Such students generally require two years to earn the S.M. degree. Applicants with prior doctoral degrees (M.D., D.V.M., D.M.D., or Ph.D. in a related area) or master's degrees in a related area are also qualified for admission, and are normally able to complete these master's programs in one year. These programs prepare students for careers in research and teaching at the graduate level.

Cancer Biology. Study programs emphasize independent research and focus primarily on viral oncology and tumor immunology. Development in the related areas of cancer epidemiology, cell and radiation biology, and cellular immunology is encouraged.

Immunology. This program develops in students the scientific background and laboratory skills needed in original research. It is based on current research in the Department of Microbiology. Applied research in infectious diseases is directed toward the chlamydiae, rickettsiae, fungi, and gonococci. Basic research problems include cell interaction, enhancement and suppression phenomena, antigen characterization, and quantitative immunochemistry. The Department has specific interests in the basic and applied aspects of the secretory immune system. Research in

tumor immunology includes the immunobiology of oncogenic viruses and immunosuppression phenomena.

Management of Communicable Disease Laboratories. Launched in 1974, this program prepares students with prior doctoral degrees (M.D., D.M.D., D.V.M., or Ph.D. in medical microbiology) for careers in laboratory management. The goal of the program is to develop administrative and management skills required in the direction of large communicable disease laboratories; these include techniques of specimen transmission, data handling, epidemiological evaluation, quality control, budgeting, recruitment, personnel and on-line management, together with knowledge of requirements for certification by state and federal agencies. Upon receipt of the S.M. or M.P.H. degree, graduates generally assume management positions in public health laboratory settings, in large hospitals, or in prepaid health care delivery systems.

Although the curriculum requires two years of residency, the breadth of the program is such that the requirements for a Master of Public Health degree may be met. Hence, most students have the option of applying for candidacy for either the *Master of Public Health* or the *Master of Science in Microbiology* degree.

Medical Mycology and Immunology. The program develops basic skills in laboratory techniques and data handling for conducting original research under direction, as well as grounding students in infectious disease etiology and control. In addition to taking courses in microbiology and tropical public health, students acquire a background in histology and pathology and engage in a related 350-level research project, normally during the second year of the program. Most of the program graduates continue toward the doctorate upon receipt of the S.M. degree; those who discontinue study may enter either research positions or positions as clinical mycologists.

Rickettsiae and Chlamydiae. This program provides intensive training in laboratory techniques, data handling, and research methodology as the groundwork for independent research. It includes studies on the biology, immunology, and epidemiology of rickettsial and chlamydial diseases. Present field and laboratory rickettsial disease projects include Rocky Mountain spotted fever in the United States and louse-borne typhus in Yugoslavia. Chlamydial projects in progress include study of trachoma and nongonococcal urethritis in man and a sexually transmitted chlamydial infection in guinea pigs which is being developed as a model for the study of sexually transmitted diseases in man.

Under the auspices of the Center for Study of Sexually Transmitted Diseases, the student may undertake clinical, epidemiological, or laboratory research in a unit of the Center with one or more of the following sexually transmitted organisms: treponemes, gonococci, mycoplasma, chlamydiae, streptococci, candida, and herpesviruses (including cytomegaloviruses). The program includes opportunities for study of the immunological responses of the host to these agents.

Virology. Students in this program are directed toward laboratory research in viral oncology, environmental virology, viral immunology, or viral epidemiology. Research programs may be either basic or applied in nature, depending on the student's interests and career goals.

Master of Science in Nutrition

The program leading to the degree of *Master of Science in Nutrition* is a flexible program that can be adapted to the background and career interests of individual students. Its general goal is to provide basic information in nutrition and to develop basic skills in laboratory techniques and data handling for undertaking original research under direction. Students are normally expected to take courses in public health nutrition, nutrition policy, and the biochemistry and physiology of nutrition, as well as the departmental seminar and an acceptable course in biochemistry.

The program is perceived as preparation for doctoral study. Students with bachelor's degrees in biology, chemistry, or nutritional sciences normally require two years to complete the S.M. program requirements, while students with master's or higher degrees in such fields as biochemistry, physiology, or other related fields usually complete the program in one year.

Master of Science in Physiology

At present, there are three areas of specialization in which programs are offered leading to the degree of *Master of Science in Physiology*: environmental or respiratory physiology; radiobiology; and toxicology. A fourth program, in occupational medicine, may lead either to the degree of *Master of Science in Physiology* or to the degree of *Master of Industrial Health* (M.I.H.).

Environmental or Respiratory Physiology. This is a two-year program, primarily for students with prior bachelor's degrees in the

physical sciences, or in biology with a strong physical science and mathematical component, who intend to continue toward a doctorate.

As a predoctoral program, the curriculum is aimed at providing students with substantive knowledge of respiratory physiology as a special field within organismic physiology, based on cell biology, biochemistry, biophysics, and biomathematics. The program is also designed to assist students in developing skills necessary for performing research in respiratory mechanics, respiratory defense mechanisms, and pathophysiology of respiratory disease; these include skills in statistics, experimental design, bioinstrumentation, and computation.

Radiobiology. This program is intended to prepare students with prior background in biology and/or physics for doctoral study, as the basis for research careers in radiation biology and experimental carcinogenesis. Its goal is to offer the academic preparation and develop the basic skills in laboratory techniques and data handling necessary for undertaking original research. It is designed as a two-year program, which some students with master's degrees in related areas (e.g., biology, radiation biology, biochemistry) may complete in one year. The majority of students continue toward a doctorate; those who have discontinued study after receiving the S.M. degree have entered research- or service-oriented careers in radiological health.

Toxicology. The program in toxicology is a two-year program intended primarily for students with recent baccalaureate degrees in biology or chemistry. It provides systematic knowledge of the health implications of environmental chemicals, combined with the in-depth knowledge of basic biomedical sciences necessary for subsequent doctoral research in a specific area. Most of the students continue in doctoral study and enter research or academic careers upon receipt of the doctoral degree.

The curriculum is fairly structured in both years of the program. Students with prior master's degrees and background in relevant areas may be able to complete the program in one year.

Occupational Medicine or Master of Industrial Health (M.I.H.). The program in occupational medicine is strictly a one-year program for physicians and may lead either to the degree of *Master of Science in Physiology* or to the *Master of Industrial Health* degree described elsewhere. The goal of the program is to prepare physicians for both theoretical and practical aspects of careers in occupational medicine

as a special field of preventive medicine and public health. In one year only part of this goal can be achieved — to provide the student with basic knowledge of industrial processes and hazards; illnesses and impairments associated with occupations; control of occupational hazards; and similar topics. Minimum skills are expected in epidemiologic and statistical methods, environmental assessment and monitoring, and related techniques.

The student is expected to continue in doctoral status or in residency training, primarily in epidemiologic aspects of occupational medicine. Upon completion of the residency phase, the student is eligible for certification by the American Board of Preventive Medicine.

Master of Science in Population Sciences

There is wide variability among the programs of individual candidates for the degree of *Master of Science in Population Sciences*, reflecting the diversity of the students' backgrounds, national origins, previous education, areas of professional concern, and career goals. Given these varied curriculum needs, the overall goals of the program are to develop sophistication in data and information management and evaluation, as well as to provide a broad philosophical perspective on problems and issues in the population field. Although the Department of Population Sciences does not offer defined programs, students have concentrated in such areas as demography, population policy and planning, family planning programs, and reproductive biology.

Students with bachelor's degrees in biological and/or social sciences, or in other population-related fields, are generally expected to spend two years in residence toward the S.M. degree. Students with prior master's or higher degrees, or extensive work experience, generally complete study toward the S.M. degree in one year.

Master of Science in Tropical Public Health

There are four programs leading to the degree of *Master of Science in Tropical Public Health*. Two are basically one-year programs — tropical public health, and medical and public health virology. The other two — ecology and control of vectors of disease, and medical and public health parasitology — are primarily two-year programs.

Tropical Public Health. This one-year program is designed for stu-

dents with prior medical degrees (M.D., D.V.M., D.M.D., D.D.S.) or doctoral degrees in biomedical science who are interested in problems of infectious disease in developing countries. The program has the following goals: (1) to provide students who have adequate training in the health sciences with the additional background essential for careers in research or service in developing countries; (2) to introduce students to the significance, recognition, and prevention of the major infectious disease problems of developing countries; and (3) to introduce them to the factors influencing human ecology and social development in such areas.

Medical and Public Health Virology. This is primarily a one-year program geared to students with prior medical degrees, doctorates in microbiology or associated fields, or master's degrees in basic biological sciences, biology, or microbiology. Students deficient in specific requisite areas may be required to spend a second year in residence.

The program is regarded as predoctoral training for students interested in careers in teaching and research in the area of medical virology. Most graduates continue toward a doctorate. The goals of the program are to provide familiarity with technical procedures needed in the study of immunopathogenesis of human viral pathogens, and to introduce students to problems of control of endemic and epidemic viral diseases in human populations.

Medical and Public Health Parasitology. Students with prior M.D. degrees or doctoral or master's degrees in biological or medical sciences are eligible for admission to this program. The exceptional candidate with a strong biological background but lacking a master's degree will be considered. For the student without prior preparation in pathology, biochemistry, and immunology, two years of course work are customary; students with sufficient prior preparation may complete the program in one year. The program is regarded as preparation for doctoral study, eventually leading to careers in research and teaching in the area of medical parasitology.

The goals of the program are: (1) to acquaint the student with recent advances in the area of parasitic diseases and with the present status of such diseases throughout the world; (2) to develop skills for evaluation of the current literature and of control programs; and (3) to provide adequate background for conducting research on these diseases, including their biochemical and immunological aspects.

Ecology and Control of Vectors of Disease. This is primarily a

two-year predoctoral program, which some students with previous education in relevant areas may complete in one year. Students admitted to the program normally have prior medical degrees or doctorates or master's degrees in biological or medical sciences. Almost all S.M. recipients continue toward a doctorate, in preparation for a career in teaching and research.

The specific educational goals of the program are: (1) to acquaint the student with the various arthropod and molluscan vectors of disease and to develop an appreciation of the biology of these organisms and the means for their control; (2) to prepare the student to plan and evaluate control programs; and (3) to develop skills with respect to identification, maintenance, and experimental procedures involving these organisms.

DOCTOR OF SCIENCE IN SPECIFIED FIELD

The Doctor of Science degree is an advanced graduate degree for those who intend to pursue academic or research careers in public health. The degree is granted on successful completion of a program of independent and original research in one of the basic disciplines of public health, and upon the presentation of this research in an acceptable thesis.

Doctor of Science degrees currently conferred by the School include:

Doctor of Science in Behavioral Sciences
Doctor of Science in Biostatistics
Doctor of Science in Environmental Health Sciences
Doctor of Science in Epidemiology
Doctor of Science in Health Services Administration
Doctor of Science in Maternal and Child Health
Doctor of Science in Microbiology
Doctor of Science in Nutrition
Doctor of Science in Physiology
Doctor of Science in Population Sciences
Doctor of Science in Tropical Public Health

Occasionally, a student may be admitted to candidacy for a doctoral degree in more than one discipline, if the program meets the requirements of the respective departments or programs involved.

Requirements for Admission

Applicants for admission to candidacy for one of the above Doctor of Science degrees must satisfy the Committee on Admissions and Degrees and the department of specialization as to their overall qualifications for doctoral study and their ability to undertake original research in their chosen field. All candidates for a Doctor of Science degree must hold the degree of Master of Science or its equivalent. In some instances, an applicant whose prior degrees were earned at another institution will be expected to complete the Master of Science degree at the School before being granted full admission to doctoral study. In such cases, the student will first be admitted to a Master of Science program. (It should be noted that applicants to doctoral programs are required to take the Aptitude Test of the Graduate Record Examination as part of the admissions process. Exceptions to this rule are applicants with previously earned doctoral degrees and those who have received or are in progress toward a master's degree from the Harvard School of Public Health.)

Because specific prerequisites vary with the discipline or field of specialization, prospective applicants are urged to consult the department or program to which admission is sought for more detailed information.

In every case, admission to doctoral candidacy is considered provisional until the candidate has passed both parts of the qualifying examination.

Requirements for the Degree

Doctoral candidates are required to complete a minimum of one academic year in residence at the University while enrolled in the doctoral program. However, the required work and preparation of an acceptable thesis normally require at least two full years and frequently longer.

Residence requirements are fulfilled by payment of tuition and pursuit of an approved program. It should be noted that the required year of residence for the doctoral degree is in addition to residence requirements for a master's degree from the School. That is, a year of residence while working toward a master's degree does not fulfill the residence requirement for the doctoral degree.

The first year of doctoral study is almost invariably spent in actual residence at the School. Thereafter, the thesis work may be continued

at the School or, in special circumstances, may be done *in absentia*, under arrangements described farther on.

After the student is enrolled as a provisional doctoral candidate, a doctoral program adviser is appointed by the department or field of concentration. The adviser keeps the student informed of all procedures and requirements for the degree; advises him about proper courses to be taken; decides, together with the department, when the student is prepared to take the qualifying examination; and supervises the thesis work.

Qualifying Examination. The qualifying examination for admission to full doctoral candidacy consists of two parts, A and B. Part A may be written, oral, or both. It is administered by the department of concentration and consists of a thorough examination in the field of concentration and in closely related areas.

On satisfactory completion of Part A, the candidate is eligible for Part B. This second part of the qualifying examination is an oral examination in the field of concentration and in at least two other relevant fields. Management of Part B is the responsibility of the Committee on Admissions and Degrees and the Registrar.

Both parts of the qualifying examination should normally be completed within one year of registration as a provisional doctoral candidate.

Doctoral Evaluation Committee. After the candidate has passed the qualifying examination, two faculty members are appointed to aid the adviser in the periodic evaluation of the student's progress.

Thesis. An acceptable thesis must be submitted within five years of the date of registration as a provisional doctoral candidate. The thesis should consist of one or more manuscripts suitable for publication in a scientific medium appropriate to the candidate's field. If the work is published prior to submission of the thesis, reprints may be submitted in lieu of manuscript.

The thesis must first be accepted by the department of concentration. When it is, three unbound copies should be deposited in the Registrar's Office. On request of the department, the Committee on Admissions and Degrees will appoint three or more readers. When the readers have individually evaluated the thesis, they will meet, together with one or more members of the Committee, and make a joint recommendation regarding acceptance of the thesis. The readers, as individuals or at their meeting, may call on the student for clarification, augmentation, or defense of material presented in the thesis.

If the thesis is accepted, the Committee on Admissions and Degrees may then recommend the candidate to the Faculty for the degree. The degree is voted by the Faculty at its special meetings in October, February, or June.

The unbound copies of the thesis must be in the Registrar's Office before *September first* for degrees to be awarded in November, before *January first* for degrees to be awarded at midyear, and before *April fifteenth* for degrees to be awarded in June. In order to meet these deadlines, the candidate should submit the completed thesis to his department for approval at least two weeks in advance of these dates.

Thesis Work in Absentia. For thesis work done *in absentia*, the adviser and the appointed evaluators must meet with the candidate to appraise the thesis plan. Agreement must be reached and the Committee on Admissions and Degrees must be advised in writing before departure of the student as to: (1) the acceptability and feasibility of the proposed thesis plan; (2) the timing and scope of periodic written reports which will be required of the student; (3) arrangements which have been or can be made for direct field supervision of the student; and (4) the minimum period of time the student will spend at the School before submitting his thesis for appraisal by the readers (a minimum of four months is generally recommended).

Final Seminar. There is no formal public thesis defense. However, after acceptance of the thesis by the committee of readers, the department of concentration is responsible for the arrangement of a seminar at which the candidate will present and discuss his thesis work. These seminars are announced throughout the School, and are open to faculty, research staff, and students.

Additional information on doctoral program requirements may be obtained from the Registrar's Office.

COMBINED DEGREE PROGRAMS WITH MEDICAL AND DENTAL SCHOOLS

In response to trends in medical school curricula and the increasing interest of medical students in community medicine and public health, the School offers admission to the Master of Public Health or Master of Science programs as part of a combined degree program. The medical or dental student admitted to this program can satisfy requirements for a public health degree within the four years usually

required for the Doctor of Medicine or Doctor of Dental Medicine degree. Ordinarily, such students are concurrently enrolled at the Harvard Medical School or the Harvard School of Dental Medicine, but occasionally students from other schools of medicine and dentistry are able to arrange similar programs.

Students from medical schools other than Harvard normally enroll full time for an academic year, after completion of at least two years of medical school. Harvard students are eligible for consideration after completion of one year at the Medical School or the School of Dental Medicine. Such students usually enroll full time for the fall term of their third year and complete requirements for a public health degree either by enrolling full time in the spring term or by spreading their electives in public health over a longer period.

The Master of Public Health or Master of Science degree will be awarded by the Harvard School of Public Health in the term in which the candidate will receive the doctoral degree.

RESIDENCY FOR BOARD CERTIFICATION

The School offers approved residency training leading to certification by the American Board of Preventive Medicine in the following areas:

General Preventive Medicine, in the specialty area of Epidemiology

Occupational Medicine

Residency credit is given for one or two years of study leading to the Master of Public Health or Master of Science degree, and one or two years of more advanced work including supervised experience which may or may not be part of a doctoral program.

Further details on the residency programs can be obtained from Dr. James L. Whittenberger, Associate Dean and Head of the Department of Physiology.

None of the residencies as such involves stipend or other financial support. Some financial support may be available through traineeships or National Research Service awards for degree programs (U.S. citizenship or permanent residence status required). Further information on financial aid can be obtained from:

Dr. Brian MacMahon (Professor and Head, Department of Epidemiology)

Dr. James L. Whittenberger (Professor and Head, Department of Physiology)
Ms. Margaret C. Salmon (Financial Aid Officer)

POSTDOCTORAL FELLOWSHIP PROGRAM IN DENTAL PUBLIC HEALTH AND ECOLOGY

The School of Dental Medicine, in cooperation with the School of Public Health and the Massachusetts Department of Public Health, offers a program covering three academic years of postdoctoral study, intended to prepare a limited number of individuals for creative full-time teaching, research, or administrative careers in dental public health and dental ecology. Each person accepted into the program will be appointed as a Clinical or Research Fellow in Dental Ecology at the School of Dental Medicine. The program is open to dentists, dental hygienists, and other qualified health professionals.

The program is in three parts of approximately one year each, which need not be completed in succession. One part of the program involves a formal course leading to a degree of Master of Public Health. Candidates with an M.P.H. or equivalent from another school, however, may be accepted into the program with one year advanced standing. The second portion involves a one-year supervised residency at the state or community level, in cooperation with the Massachusetts Department of Public Health. This residency meets the requirements of the American Board of Dental Public Health. The third portion affords opportunity for advanced didactic work and research at the School of Dental Medicine, the School of Public Health, other departments of the University, and/or other institutions. Epidemiological or other research work can be carried on over the entire three-year period in a variety of situations involving either new or continued studies. A research thesis is prepared for presentation at the end of the third year.

Fellows in Dental Ecology who wish to become candidates for a degree in public health must meet the admission requirements of and be accepted into the School of Public Health. Application should be made directly to the School of Dental Medicine, whose Committee on Postdoctoral Education will forward the applicant's file to the School of Public Health for consideration.

Upon successful completion of this program, the candidate may receive the M.P.H. degree from the School of Public Health, as well as

a Certificate of Postdoctoral Study in Dental Ecology and a certificate of completion of residency requirements from the Harvard School of Dental Medicine.

Academic study beyond the master's level may be arranged with the School of Public Health and other departments of the University.

For further information and application forms, write to the Director, Department of Dental Ecology, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, Massachusetts 02115.

Departments and Courses of Instruction

In the course listings below, course numbers from 100 to 199 indicate undergraduate and graduate courses; numbers from 200 to 299 indicate primarily graduate courses; and numbers from 300 to 399 indicate graduate courses of reading and research.

The letters "a," "b," "c," "d," and "e" following the course number indicate the period(s) in which a course is given, with "a" denoting first period, "b" second period, "c" third period, and "d" fourth period. The letter "e" indicates supervised special studies or field observations, usually during the one-week period between fall and spring terms or during the post-class period following the spring term.

The credit assignment is given in units following the statement of number and length of sessions per week. The phrase "Additional credit may be arranged" indicates that the student may earn additional credit by attending supplementary class meetings, doing extra reading, or otherwise devoting additional time to the course.

INTERDEPARTMENTAL COURSES

Interdepartmental 201b. Historical Analysis of Public Health Policy and Practice: United States, 1900-1975

Lectures, section meetings. *Two 1½-hour sessions each week. 2.5 units.* Dr. Rosenkrantz.

This course identifies six issues to illustrate the relationship between social experience and professional responsibility for prevention of disease. Topics selected for analysis based on historical examples illustrate policy-related issues: how health hazards are identified; determinants of resources; criteria of efficacy and equity in policy and services. The course is recommended for students who wish to relate their special competence to the network of objectives in public health.

Interdepartmental 202. Introduction to Instructional Design in the Health Field

Self-instructional course, supplemented by small-group discussion. May be taken first or second period. 2 units. (Instructor to be announced).

This introductory course is designed for students who are preparing for careers in the education of health professionals. A systematic approach to instructional design is presented through a model program which includes analysis of professional responsibilities and performance, specification of educational objectives, design of instructional activities, and evaluation of the educational process and outcome. Examples are drawn primarily from the fields of community medicine and public health.

Enrollment is subject to the approval of the instructor.

Interdepartmental 203c. Course and Curriculum Development in the Health Fields

Self-instructional course, supplemented by small-group seminars. 2 units. (Instructor to be announced).

This is an advanced course recommended for students who currently hold

faculty appointments in health professions schools or training programs, or who anticipate such an appointment upon completion of their studies. Using the model for instructional design developed in Interdepartmental 202, students plan a complete course or segment of curriculum in an area of individual selection.

Prerequisite: Interdepartmental 202.

Enrollment is subject to the approval of the instructor.

Interdepartmental 204c,d. Seminars on Educational Policy

Seminars. *One 2-hour session each week; time to be arranged. 2 units. Additional credit may be arranged.*

Not given in 1977-78.

Seminars are offered on policy issues related to training programs in community medicine and public health for specific categories of health manpower, including physicians, dentists, and allied health professionals in the United States, and health professionals in developing countries. Through individual instruction and seminar discussions, students will assess the impact of professional expectations, social needs, and institutional constraints on the selection of educational goals.

Interdepartmental 208a,b. Human Rights in Health

Lectures. *One 2-hour session each week. 3 units.* Dr. Curran.

This course entails a comprehensive examination of human rights as they bear upon health programs, nationally and internationally. Among topics considered from ethical, cultural, and legal viewpoints are: rights to medical care and a healthy environment; equality; rights of medical patients, women, children, and experimental subjects; and problems of balancing personal rights and community protection.

Interdepartmental 209a,b. Health Services in Developing Countries

Seminars. *Two 1-hour sessions each week. 2.5 units.* Dr. Joseph, Dr. Wray, Miss Cohn, Dr. Cash.

This course centers on the following issues: analysis of the special health problems facing developing countries and of the organizational alternatives for utilizing health resources; the nature, composition, and training of the health team for use at the local and district levels; the relation of health to development and the position of health in national planning priorities.

Interdepartmental 210a,b. Economic Analysis for Public Health

Lectures, discussions. *Two 1½-hour sessions each week. 4 units.* Dr. Berry, Dr. Taylor.

This course provides an introduction to the basic principles of economics

and economic analysis, particularly as they apply in the public health field. A systematic introduction to microeconomic theory includes the determinants of supply and demand, the theory of markets, and the concept of economic efficiency. In addition, attention is given to public expenditures and policy analysis.

Interdepartmental 212c. Biomedical Writing

Seminars. *One 2-hour session each week. 2 units.* Dr. Chernin.

Writing scientific papers is an integral part of the research process. This course develops practical skills and experience in planning and writing articles that meet the editorial demands of biomedical journals. The salient elements of a well-prepared article — logical organization, clear and concise scientific prose, and understandable tables and figures — are emphasized by criticizing short papers written by the participants on biomedical subjects of their own choice.

Enrollment is limited to 10 students, with advance approval of the instructor.

Interdepartmental 214a,b. Accelerated Introduction to Biostatistics

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Thibodeau.

This course is an introduction to biostatistics for students with a good quantitative background. The objectives are to foster an awareness of the importance of statistical reasoning and lay a foundation that can be built on. Specific topics are Bayes theorem, rate adjustment, life tables, simple and multiple regression, and hypothesis testing. These include the topics covered in Biostatistics 101 and some of the material in Biostatistics 202.

Prerequisite: One college-level course in mathematics.

Required for students in the Health Policy and Management Program.

Interdepartmental 214c,d. Quantitative Methods for Health Policy and Management

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Thompson, Dr. Sahney.

The purpose of this course is to provide students with motivation to analyze health problems quantitatively, understanding of a broad range of quantitative techniques and ideas, technical competence in a selected few techniques, and the critical capacity to evaluate realistically the power and limitations of quantitative analysis.

Prerequisite: Interdepartmental 214a,b or permission of the instructor.

Required for students in the Health Policy and Management Program.

Interdepartmental 215c,d. Environmental Health Evaluation and Management

Seminars, lectures. *Two 1½-hour sessions each week; additional computational sessions to be arranged. 5 units.* Dr. Harrington.

This course introduces concepts and analytical methods for the quantitative evaluation and management of man's environment. Topics discussed include the development of natural resources, resulting environmental conditions, and effects on human health. Where appropriate, mathematical models are developed and critiqued in a systems analysis framework. Students are required to submit a term project.

A principal elective for students in the Health Policy and Management Program. A strong background in college-level mathematics is assumed.

Interdepartmental 216c,d. A Social History of Disease and Health in America from the Revolution to World War II (Social Sciences 114)

Lectures, discussions. *Two 1-hour sessions each week; additional 1-hour discussion session to be arranged for students in the Medical Area. 5 units.* Dr. Rosenkrantz.

This course analyzes the changing definition of disease and health based on the study of American experience and expectation. The influence of demographic and epidemiologic events on health and the perception of health is discussed. The course includes a historical analysis of such topics as the origins of contagionist and anticontagionist viewpoints; responses to epidemics of the nineteenth and twentieth centuries; and the locus of authority for medical practice.

Students in the Health Policy and Management Program are required to take either this course or Health Services Administration 218c,d.

DEPARTMENT OF BEHAVIORAL SCIENCES*

Robert J. Haggerty, A.B., M.D., Roger Irving Lee Professor of Public Health (Health Services and Pediatrics) and Acting Head of the Department

Faculty: Visiting Professor Mertens; Associate Professors R. Benfari, McAuliffe, J. Murphy, and Sheldon; Lecturer Wechsler

Teaching and Research Staff: Lecturers and Visiting Lecturers J. Barrett, Klerman, Krant, and Rolde

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The Department of Behavioral Sciences has a primary concern with the relationship of social and cultural factors to mental health and mental illness and the way social, cultural, and psychological factors affect the development and effectiveness of planned changes, particularly those involving public health programs.

Students have the opportunity to study psychiatric epidemiology, cross-cultural psychiatry, the characteristics of mental health services, and the role of cultural factors in health and disease. Considerable emphasis is given to research and research methodology.

The teaching plan is geared both to the student who has a social science background and wishes to know more about mental health and illness, and to the student who has a clinical orientation and wishes to know more about the social, cultural, and psychological influences which shape the human community. The Department participates in the programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (A description of programs leading to the degree of S.M. in Behavioral Sciences may be found in the section entitled "Admission and Degree Requirements and Academic Programs.")

Behavioral Sciences 202a,b. Styles of Pathological Behavior: An Introduction to Public Health Psychiatry

Seminars. *One 3-hour session each week. 2.5 units each period.* Dr. Benfari, Dr. Rolde.

The "a" period focuses on individuals whose behavior is considered antisocial or dangerous by society (violence, delinquency, addiction, psychopathy, child abuse). The emphasis is on the avoidance of stereotypes. The "b" period presents a sociopsychological approach to abnormal psychology and an eclectic examination of concepts in mental illness, including the lifestyles of psychosis, retardation, neurosis, and depression.

The course is intended for students with a wide variety of backgrounds. Either period may be taken separately. (Note: Dr. Rolde is the principal instructor for this course.)

*The Department of Behavioral Sciences is functioning for administrative purposes within the Department of Health Services (described later in this catalog).

Health Services Administration and Behavioral Sciences 203a,b. Administration and Organization of Health Services

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units each period.* Dr. Benfari, Dr. Neuhauser.

(Course is described under Department of Health Services.)

Behavioral Sciences 204c,d. Psychiatric Epidemiology: Problems, Concepts, and Methods

Seminars. *One 3-hour session each week. 5 units.* Dr. Wechsler.

The aim of this course is to introduce students to the field of psychiatric epidemiology. The emphasis in the "c" period is on studies of major psychoses such as schizophrenia using data obtained from psychiatric treatment services and institutions. In the "d" period, emphasis is given to the assessment of mental health in total populations through field surveys.

Prerequisites: Epidemiology 201a, Biostatistics 101a,b, or permission of the instructor. Either period may be taken separately, although it is recommended that students take both periods.

Behavioral Sciences 205c. Social Indicators

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Murphy.

This seminar deals with various ways of conceptualizing and measuring social processes of relevance to public health, with particular reference to mental health and mental illness. This includes studies of community integration, social class, and poverty. In addition, attention is given to the family, anomie, social networks, cultural values, and behavior settings. The course is designed especially for students who plan to work in fields such as social psychiatry, medical anthropology, or medical sociology.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 206c,d. Mental Health in the Non-Western World

Lectures, seminars. *One 2-hour session each week. 5 units.* Dr. Murphy.

This course surveys mental and emotional problems in non-Western areas. Topics include cultural relativity in definitions, epidemiological findings, and the role of stress through cultural change, poverty, community disintegration, etc. Indigenous treatments and modern services for the mentally ill are discussed.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 207a,b. Personality Assessment in Field Surveys

Seminars. *One 2-hour session each week. 5 units.* Staff of the Department.

This course familiarizes the student with various data-gathering techniques, such as clinical interviews, structured questionnaires, peer judg-

ments, and standardized observations used in studying mental health and illness in populations. One segment of the course deals with the conceptualization and measurement of positive adaptation; another deals with assessing mental health of children.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 208a,b. Sociology of Addiction

Seminars, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. McAuliffe.

Not given in 1977-78.

Through lectures and discussions, the course covers the following topics: epidemiology, diffusion of drug use among peer groups, public policy, strategies of treatment and prevention, drug effects on maternal and child health, program planning and administration, deviant careers of addicts, social control, and community responses to sociomedical problems.

Behavioral Sciences 209c,d. Evaluation of Mental Health Services

Seminars. *One 1½-hour session each week. 2.5 units.* Dr. Haggerty, Dr. Klerman.

This course examines a selected number of mental health services, at the level of the individual, the institution, the community, and the nation, as to their scientific and research aspects and their political and social impact. Scientific questions are asked concerning the efficacy and unintended consequences of services. (Note: Dr. Klerman is the principal instructor for this course.)

Behavioral Sciences 210d. Inducing Social Change

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Mertens.

This course is designed for various specialists in public health who are charged with responsibility for introducing changes in organizations and communities. The subject matter includes methods and theories of teaching, principles of individual and group psychotherapy, approaches to sensitivity training and group dynamics, and organizational theory. Techniques and procedures illustrating these theories are presented through readings, discussions, and case illustrations.

Behavioral Sciences 211d. Psychiatric Problems in Organizations and Industry

Lectures, readings, case illustrations. *One 2-hour session each week. 2.5 units.* Dr. Mertens.

The course is designed to provide basic information relevant to clinical and case management in industrial and other organizational settings. It analyzes research and clinical findings in such a way as to prepare students to handle not only individual maladaptation, but also disintegration

at the organizational level. It presents successively etiology and symptomatology of individual and group dysfunction and is designed for students who already have a basic knowledge of psychopathology.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 213c,d. Managing Human Resources in Health Care Settings

Lectures, discussions. *One 3-hour session each week. 5 units.* Dr. Benfari.

Drawing heavily upon the applied behavioral sciences, this course is designed to provide future planners and managers in health care settings with knowledge and skills in designing and structuring organizations; planning and goal setting in complex environments; clarifying and allocating role responsibilities; making effective decisions; improving the effectiveness of teams; managing interprofessional conflicts; and managing the process of change.

Behavioral Sciences 215c,d. Methods of Social Research (Sociology 210)

Lectures, discussions. *Three 1-hour sessions each week. 5 units.* Dr. McAuliffe.

Social research methods, including participant observation, social experiments, and surveys, are examined with respect to design, measurement, and sampling. Topics are discussed at an advanced level appropriate for doctoral students or master's degree students specializing in methodology.

Prerequisite: Statistics through multiple regression and factorial analysis of variance is assumed.

Behavioral Sciences 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged. Staff of the Department.

Arrangements can be made for a reading course in selected topics or practical experience in research.

Behavioral Sciences 330e. Field Study

A limited number of openings exist for research experience in the Department's field stations. These opportunities vary in nature from time to time according to the stages of various research projects. Individual arrangements can be made through the Head of the Department.

Behavioral Sciences 350. Research Training

Training in research is available to doctoral candidates through individual arrangements with the staff of the Department. Topics offered include "Public Health Research in Community Settings" (Dr. Wechsler).

DEPARTMENT OF BIOSTATISTICS

C. Frederick Mosteller, S.B., S.M., Ph.D., S.D. (hon.), Professor of Mathematical Statistics and Head of the Department

Faculty: Professors and Visiting Professors Bailar, Miettinen, Reed, and Zelen; Associate Professors Bishop, Drolette, and Frazier; Assistant Professors Begg, Costello, Gelber, Hanley, Laird, Lavin, MacIntyre, Mietlowski, Schoenfeld, Stanley, Thibodeau, Warram, and Waternaux; Lecturer Jones

Teaching and Research Staff: Lecturers and Visiting Lecturers Bauer, Kent, Neff, and Wyshak

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The teaching aims of the Department of Biostatistics may be divided very generally into three categories:

First, it is essential for workers in all branches of public health to be able to draw justified conclusions from numerical data and to base logical action on these conclusions. This applies to the administrator who must evaluate problems and the results of his activities, as well as to the epidemiologist and the research worker who must apply statistical techniques to their laboratory and field problems. The course Biostatistics 101a,b is therefore designed to give not only a minimum command of simple methodology to all students but an appreciation of the value of the method and an awareness of the frequent abuse encountered in the health literature.

Second, field and laboratory researchers must be able to use statistical methods in planning and analyzing their experiments and problems. Some elective courses are designed to provide an introduction to methodology in this area. These courses are adapted to the needs of students of this School, many of whom have broad backgrounds in biological sciences while few have extensive preparation in mathematics. A minimum of mathematical exposition is therefore included in some courses intended for students in these categories. Other electives go into more depth in particular topics. In all electives the emphasis is on understanding the underlying assumptions inherent in standard statistical procedures and on the ability to determine when such procedures are appropriate.

Third, there is a smaller group of students particularly interested in graduate work in biostatistics. To meet the needs of these students, the Department offers programs leading to the degrees of Master and Doctor of Science in Biostatistics. A description of the Master of Science program and a general description of the doctoral programs offered by the School may be found in the section entitled "Admission and Degree Requirements and Academic Programs."

Any course in the Department is open to any student who meets the prerequisites stated in the course description.

Biostatistics 101a,b. Principles of Biostatistics

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 3.5 units.* Staff of the Department.

Lectures and laboratory exercises acquaint the student with demographic concepts, the nature and composition of rates, and their uses in administration and epidemiology. The theory of measurements and distributions including estimation and tests of significance are discussed. Basic concepts of probability and association, sampling techniques, and study design are introduced.

Biostatistics 202c,d. Statistical Methods in Research

Lectures, discussions, laboratory. *Two 3-hour sessions each week. 5 units.* Staff of the Department.

This course, a continuation of Biostatistics 101a,b, introduces the student to technical statistical procedures important in problems of laboratory and field research. Topics included are further considerations of probability and chi-square techniques, together with an introduction to procedures used in the planning of experiments, including variance analysis, nonparametric methods, dosage response, and regression.

Prerequisite: Basic preparation in statistics.

Epidemiology and Biostatistics 203b. Principles of Epidemiologic Research I: Problem Conceptualization and Study Design

Lectures, seminars. *Two 2-hour sessions each week. 4 units.* Dr. Miettinen.

(Course is described under Department of Epidemiology.)

Epidemiology and Biostatistics 203c. Principles of Epidemiologic Research II: Data Analysis and Inference

Lectures, laboratory. *Two 2-hour sessions each week. 3 units.* Dr. Miettinen.

(Course is described under Department of Epidemiology.)

Epidemiology and Biostatistics 204c,d. Principles of Epidemiologic Research III: Applications

Tutorials, seminars. *Tutorial sessions during third period; one 2-hour seminar each week during fourth period. 2.5 units.* Dr. Rothman.

(Course is described under Department of Epidemiology.)

Biostatistics 205c,d. Mathematical Foundations of Biostatistics

Lectures. *One 2-hour session each week. 2.5 units.* (Instructor to be announced).

The material covered includes mathematical descriptions of commonly used distributions, standard procedures for estimating the moments of a

distribution, and mathematical foundations of statistical inference, including the Neyman-Pearson lemma, the likelihood ratio, the central limit theorem, power and Bayesian inference.

Prerequisite: A course in elementary calculus.

Biostatistics 207c,d. Survey Research Methods in Community Health

Lectures, discussions. *One 2-hour session each week. 2.5 units.* (Instructor to be announced).

Research design, sample selection, questionnaire construction, interviewing techniques, the reduction and interpretation of data, and related facets of population survey investigations are covered. The course is focused primarily on the application of survey methods to problems of health program planning and evaluation. The treatment of methodology is sufficiently broad to be suitable for students who are concerned with epidemiological, nutritional, or other types of survey research.

Biostatistics 210. Advanced Topics in Biostatistics

Lectures, discussions. *One 2-hour session each week. 2.5 units per semester.*

This course is offered primarily for students majoring in biostatistics or epidemiology, though other qualified students are welcome. It may be offered in the first semester ("a" and "b" periods), in the second semester ("c" and "d" periods), or in both. Topics and instructors will be announced.

Biostatistics 211c,d. Discrete Multivariate Analysis

Lectures, discussions. *One 2-hour session each week. 5 units.* Dr. Bishop.

This course deals with the use of log-linear models for describing multidimensional contingency tables. Emphasis is on practical application rather than mathematical theory. Topics covered include use of such models for determining when tables can be reduced in size without changing the relationships between variables, hypothesis testing, obtaining rates standardized for more than one underlying variable, and combining data sets from different sources.

Prerequisite: A statistics course which includes analysis of variance.

Biostatistics 213b. Computing Principles and Methods

Lectures, discussions, laboratory. *Two 2-hour sessions each week. 2.5 units.* Dr. Drolette, Mr. Neff, Staff of the Health Sciences Computing Facility.

Among the principles and methods of computing and data processing included in the course are programming, flow-charting, and use of program packages and libraries, particularly criteria for choosing among

existing programs. Case studies are used to illustrate methods of data collection, coding, and data reduction.

Enrollment is subject to the approval of the instructor.

Biostatistics and Health Services Administration 216c,d. Health Program Evaluation

Lectures, discussions. *One 2-hour session each week. 2 units each period. 216c may be taken without 216d.* Mr. Frazier, Dr. Reed.

This course is designed to increase the student's ability to understand the uses and limitations of methods employed to evaluate health programs. The course provides an overview of the purposes and procedures of evaluation methods as applied to health programs. The course is sufficiently broad to be of interest to program administrators and to health program analysts.

Biostatistics 220c,d. Multivariate Analysis for Quantitative Data

Lectures, student presentations. *Two 1½-hour sessions each week. 5 units.* Dr. Drolette.

Topics covered include multiple regression, principal component and factor analysis, discriminant functions, clustering, and canonical correlation, with some discussion of distribution theory and tests of hypotheses. Students will participate in the analysis of a data set.

Prerequisites: At least one statistics course beyond the level of Biostatistics 101a,b, knowledge of matrices, and, if possible, some familiarity with computer programs such as SPSS.

Biostatistics 240c,d. Design of Experiments (Statistics 140)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Laird.

This course examines general principles and practical difficulties in controlled experimentation. Topics covered include an introduction to randomization theory, methods for increasing precision, principal types of designs, mixed and random effects models, and variance component estimation. The course is intended both for students with a primary interest in statistics and biostatistics and for students in the experimental sciences.

Prerequisites: One or more courses covering the basic concepts of distributions, expectations, samples, testing, estimation, regression, and analysis of variance.

Health Services Administration and Biostatistics 290c. Analysis of Health and Medical Practices (Public Policy 290)

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Dr.

Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).

(Course is described under Department of Health Services.)

Biostatistics 310-315a,b,c,d. Tutorial Programs

Time and credit to be arranged. Staff of the Department.

An opportunity for tutorial work at the master's level is offered for interested and qualified students or small groups of students. Arrangements must be made with individual faculty members and are limited by the amount of faculty time available. These tutorial programs are open to students specializing in biostatistics and also to students in other fields who wish to go beyond the content of the regular courses. Six broad categories of this tutorial instruction are identified by the six course numbers below.

310 *Tutorial in Statistical Methods*
Guided study in specific areas of statistical methodology and application.

311 *Tutorial in Teaching*
Work with the Department in laboratory instruction and the development of teaching materials.

312 *Tutorial in Consultation*
Work with members of the Department on current statistical consultation activities.

313 *Tutorial in Computing*
Guided study in scientific programming, numerical methods, and data management.

314 *Tutorial in Study Design*
Guidance in developing statistical design of a study in which the student has a particular interest.

315 *Tutorial in Data Analysis*
Guidance in the statistical analysis of a body of data in which the student is interested.

Students may register for Biostatistics 310-315 for a maximum of ten credit units in the summer term.

Biostatistics 350. Research

Candidates for the Doctor of Public Health, Doctor of Science, or other doctoral degrees may arrange for individual research. The work may be part of the program for a doctorate in this Department or may be integrated with doctoral research in other departments.

ENVIRONMENTAL HEALTH INTERDEPARTMENTAL COURSES

The following courses are conducted by the faculty and staff of the Kresge Center for Environmental Health, which includes the Departments of Environmental Health Sciences, Physiology, and Sanitary Engineering.

Environmental Health Interdepartmental 201a,201b. Principles of Environmental Health

Lectures, discussions. *Two 1-hour sessions and one 2-hour session each week. 2.5 units each period.* Dr. Moeller, Staff of the Kresge Center.

This course reviews the more important environmental health problems facing society. Topics in the "a" period include environmental radiation control, community air pollution, occupational health, and selected physical stresses. Topics in the "b" period include basic sanitation, water purification, traumatic injuries, environmental law and economics, environmental toxicology, land use planning, and environmental health implications of energy use. Either period may be taken separately.

Environmental Health Interdepartmental 202d. Community Environmental Health Management — A Computer-Simulated Gaming Experience

Lectures, discussions, role playing. *One 3-hour session each week. 2.5 units.* Dr. Spengler, Staff of the School of Public Health.

This is a computerized game which simulates a metropolitan environment by including basic data on such factors as air pollution characteristics, employment, land use, and public services. By playing such roles as air pollution control officers, politicians, town planners, industrialists, and land developers, students are given the opportunity to make decisions on issues raised by the community.

Enrollment is limited to 60 students.

Environmental Health Interdepartmental 204c,d. Human Factors in Occupational Performance and Safety

Lectures, demonstrations. *One 2-hour session each week. 2 units.* Dr. Snook.

This course emphasizes the design of the job to fit the worker. Specific problems are investigated which result from the nature of the job itself, e.g., low back injuries, fatigue, hand disorders, slips and falls, human error, and psychological stress. The physiological, psychological, and anatomical characteristics of the worker are considered in the development of good job design principles.

Environmental Health Interdepartmental 206c,d. Occupational Medical Clinics

Clinics. *One 2-hour session each week. 2 units.* Dr. Fine, Dr. Murphy.

These clinics are concerned with occupational diseases, such as silicosis, beryllium intoxication, coal miner's pneumoconiosis, and lead poisoning. Special clinics are held in ophthalmology and dermatology.

The clinics are limited to physicians and are not offered if less than 4 students enroll.

Environmental Health Interdepartmental 207c,d. Policy Issues in Occupational Health

Lectures, seminars. *One 2-hour session each week, third period; two 2-hour sessions each week, fourth period. 3 units.* Dr. Peters, Dr. Wegman, Mr. Boden.

This course considers roles of different agencies and institutions in achieving a healthful workplace, including government, corporations, unions, and research organizations. Representatives of each will present their views. The political, economic, and legal foundations of the actors and their interactions are highlighted. The nonscientific uses of scientific information will be explored.

Environmental Health Interdepartmental 209c,d. Mathematical Modeling for Health Sciences

Lectures, discussions. *Three 1-hour sessions each week, third period; two 2-hour sessions each week, fourth period. 4 units.* Dr. Dawson.

A range of models for the space and time dependence of the key variables in natural systems is discussed. Specific applications emphasize processes that characterize the response of the organism to its environment. The inverse problem of using measurements to infer estimates of parameters of models is developed.

Prerequisites: Calculus, Physiology 203a,b, and statistics to the level of concurrent enrollment in Biostatistics 202c,d, 205c,d, or 210c,d.

Environmental Health Interdepartmental 330e. Field Work

One-week period between fall and spring terms. 1 unit.

A week of supervised field observation is offered during the one-week period between fall and spring terms. Students may choose appropriate visits to medical or industrial hygiene departments of industries, airports, and other agencies which have operations or research in the field of environmental health.

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES

Dade W. Moeller, S.B., S.M., Ph.D., A.M. (hon.), Professor of Engineering in Environmental Health, Head of the Department, and Associate Director, Kresge Center for Environmental Health

Faculty: Professor First; Associate Professors Burgess and Dennis; Assistant Professors Cooper, Hinds, D. H. Leith, Smith, and Spengler; Lecturers Bjarngard, Cudworth, Judy, Shapiro, and Webster

Teaching and Research Staff: Lecturers and Visiting Lecturers Anderson, J. M. Austin, Billings, Dane, Mahoney, Naegele, Nelson, O'Connor, Schulte, Svensson, Viles, and Zimmerman; Research Associates Grubner, Underhill, and Wolfson

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Because of growing public awareness of the need for environmental pollution control and worker protection, increasing attention is being focused on these problems at all levels of our society. Research and training have been conducted on these major subjects at the Harvard School of Public Health since 1918. Applicable curricula offered by the Department of Environmental Health Sciences include air pollution control, environmental health management, industrial hygiene, medical radiological physics, and radiological health. In addition to specialized courses, graduate education in each of these fields includes courses on human physiology, epidemiology, and biostatistics. Programs of the Department are open to engineers, physicians, and other professional personnel with undergraduate backgrounds in physics, chemistry, mathematics, and biology. (For a description of the Master of Science programs offered by the Department, see the section entitled "Admission and Degree Requirements and Academic Programs.")

Supporting the teaching program are extensive research activities. Current studies include the evaluation of the exposure of workers to air contaminants, assessment of the environmental impact of nuclear facilities, medical radiation applications and dosimetry, the design of cleanup systems for radioactive sodium aerosols, the application of gas- and liquid-phase reactions to particulate and gas removal, a numerical study of urban scale atmospheric transport, the monitoring of worker stresses by telemetered physiological measurements, and an investigation of the population dose from radiation of natural origin. Supporting these studies are related cooperative research projects conducted by the Departments of Physiology and Epidemiology. As a result, students have many excellent opportunities for research, either on an independent basis or as a participant in an ongoing project.

As may be noted, some of the courses in this Department carry "Engineering" numbers. These are cross-listed in the catalog of the Division of Applied

Sciences in Cambridge and provide course credit through that Division as well as through the School of Public Health.

Environmental Health Sciences 202b. Departmental Seminar

Seminars. *One 2-hour session each week. 1 unit.* Staff of the Department. The purpose of these seminars is to supplement the formal course work of the Department by bringing to the attention of students a wide range of topics of contemporary interest in air pollution control, industrial hygiene, radiological health, and environmental health management. Discussion leaders include faculty members from the Kresge Center, students from the Department, and specialists from industrial, governmental, and university research centers.

Environmental Health Sciences 211a,b. Introduction to Environmental Health Management

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. Cooper. This course focuses on quantitative and descriptive methods that can aid in decision making relative to environmental health management. Techniques such as cost/benefit analysis, optimization, linear programming, and queueing theory are reviewed in terms of their application to the determination and implementation of environmental policies. Guest speakers provide opportunities for evaluations of models and mathematical analyses as applied to specific problems.

Prerequisite: Elementary calculus.

Environmental Health Sciences 251c,d. Basic Problems in Occupational Health and Industrial Environments (Engineering 282)

Lectures. *Two 2-hour sessions each week.*

Laboratory demonstrations, field trips. *One 3-hour session each week. 5 units.* Dr. Ferris, Dr. First, Dr. Peters, Mr. Burgess.

Lectures, laboratory demonstrations, and inspections of workplaces show the relation of working conditions to health, with special reference to the recognition, measurement, and control of hazards. Examples include adverse conditions of temperature, humidity, radiation, and chemical and physical irritants. Particular emphasis is given to the prevention, diagnosis, and treatment of industrial disability and disease, and to workmen's compensation.

Prerequisite: Physiology 203a,b.

Environmental Health Sciences 252a,252b. Environmental Control (Engineering 280)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 2.5 units each period.* Mr. Burgess, Dr. Cudworth.

The first half of this course centers on the design and evaluation of industrial ventilation systems for the control of toxic contaminants released into the workplace through industrial operations and processes. The second half is designed for environmental health specialists responsible for evaluation and control of noise hazards. Topics include measurements and instrumentation, and specific control approaches for production equipment.

Environmental Health Sciences 253a,b. Aerosol Technology (Engineering 286)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 2-hour session each week, first period; one 4-hour session each week, second period. 5 units.* Dr. Hinds.

This course covers the properties of suspended particulate matter (dust, smoke, clouds) and the physical principles underlying its behavior. Topics covered include: particle motion due to gravitational, thermal, and electrostatic forces; diffusion; impaction; coagulation; filtration; condensation and evaporation; optical properties; and sizing statistics. Laboratories cover optical and electron microscopy, sampling, and mass concentration and particle size measurement.

Environmental Health Sciences 261a,b. Community Air Pollution (Engineering 284)

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. First, Dr. Leith.

This course is designed for engineers, chemists, and physicians interested in air pollution control. Topics include the measurement and control of community air pollution; pollutant dispersion; air quality standards; health effects; damage to animals, plants, and property; community and site surveys; the legal and enforcement aspects of air pollution control; the nature and quantity of atmospheric emissions from vehicles, incinerators, and specific industries.

Environmental Health Sciences 262c,d. Meteorological Aspects of Air Pollution (Engineering 285)

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. Spengler.

This course presents an evaluation of the meteorological factors associated with the transport, transformation, dispersion, and removal of air pollutants. Topics include general circulation, physical meteorology, weather forecasting, turbulent dispersion, diffusion equations, diffusion models for point, area, line, and urban sources, and instrumentation for evaluating the movement and behavior of air pollutants.

Prerequisite: Environmental Health Sciences 261a,b.

Environmental Health Sciences 264c,d. Identification and Measurement of Air Contaminants (Engineering 283)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. First, Staff of the Department.

This course emphasizes sampling and analytical methods for air contaminants plus related subjects. Included are chemical and instrumental methods of air analysis, isokinetic sampling, biological and solvent analysis, radioactive aerosol determinations, air pollution surveys, and fire and explosion evaluations. The course is recommended for concentrators in industrial hygiene and air pollution control and suggested for students in the radiological health and M.I.H. programs.

Environmental Health Sciences 265c,d. Air and Gas Cleaning

Lectures. *One 2-hour session each week.*

Laboratory. *One 2-hour session each week. 5 units.* Dr. First, Dr. Leith, Staff of the Department.

This course covers theory, selection, application, and testing of air and gas cleaning devices, including gas absorption in liquids and adsorption on solids, gas incineration, particle collection by inertial and centrifugal force, and basic processes of particle conditioning. Laboratory experiments and case studies illustrate important aspects of sizing and correct selection of equipment.

Prerequisites: Environmental Health Sciences 253a,b and 264c,d (may be taken simultaneously).

Environmental Health Sciences 271a,b. Introduction to Radiation Protection (Engineering 288)

Lectures. *Two 1-hour sessions each week.*

Laboratory, field trips. *One 3-hour session each week. 5 units.* Dr. Shapiro.

This course covers laboratory, industrial, and environmental sources of radiation; the interaction of ionizing particles with matter; the concept of radiation dose from external and internal sources; radiation measurements; radiation protection standards and regulations; and methods of environmental and occupational radiation protection. Laboratory exercises provide an introduction to the measurement and safe use of radiation sources.

Environmental Health Sciences 272d. Special Topics in Radiation Protection

Lectures, discussions. *Two 2-hour sessions each week. 2.5 units.* Dr. Shapiro.

This course covers the physical principles and mathematical analyses utilized in the evaluation and control of radiation hazards. Topics covered

include neutron slowing down and diffusion, nuclear reactor theory, criticality safeguards, radiation shielding, protection against internal emitters, and control of radioactive contamination.

Prerequisite: Environmental Health Sciences 271a,b.

Environmental Health Sciences 274c. X-ray Protection

Lectures. *One 2-hour and one 1-hour session each week.*

Laboratory. *One 3-hour session each week. Time to be arranged. 2.5 units.* Dr. Webster.

This course covers the fundamentals of X-ray equipment (both industrial and medical), the design of X-ray installations, and procedures for radiation protection surveys and inspections, and includes several problem assignments. Considerations include both equipment and room design, with emphasis on items such as leakage, collimation, filtration, primary and secondary barriers, workload, and protection of patients.

Prerequisite: Environmental Health Sciences 271a,b.

Environmental Health Sciences 281a. Introduction to Physics of Diagnostic Radiology.

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Dr. Philip Judy (Assistant Professor of Radiology, Harvard Medical School).

Given alternate years; to be given in 1977-78.

This course for students in medical physics and radiological health covers the fundamentals of diagnostic radiology, including diagnostic criteria, such as abnormal size, position, motion, or structure; principles of specific studies, e.g., cardiac angiography; and the use of contrast media. The course reviews principles of equipment employed, such as diagnostic X-ray sources, recording systems, film, screens and image intensifiers, and factors affecting image quality and patient exposure.

Environmental Health Sciences 282b. Introduction to Physics of Nuclear Medicine

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Mr. Zimmerman.

Given alternate years; to be given in 1977-78.

Production and properties of radionuclides and radiopharmaceuticals, as well as the physiological basis for medical applications, form the foundation for this course for students in medical physics and radiological health. Principles of specific studies are presented (e.g., uptake measurements, tracer kinetics, static and dynamic imaging and *in vitro* techniques). Instrumentation and factors affecting accuracy, image quality, and patient exposure are also discussed.

(Note: Mr. Zimmerman is the principal instructor for this course.)

Environmental Health Sciences 283a. Introduction to Physics of Radiation Therapy

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Dr. Svensson.

Given alternate years; to be given in 1978-79.

This course for students in medical physics reviews tumors of different primary sites, including their histology and routes of spread. Various aspects of radiation therapy are discussed, including time-dose relationships, influence of oxygen and chemical agents, tumor localization, treatment planning, and simulation. Also covered are treatment with external beams, radioactive isotopes, implants and intercavitary sources; dose calculations; and machine design and specifications.

(Note: Dr. Svensson is the principal instructor for this course.)

Environmental Health Sciences 284c,d. Physics of Diagnostic Radiology

Lectures. *One 2-hour and one 1-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Webster.

Given alternate years; to be given in 1977-78.

This course deals with the physical and mathematical aspects of image formation, including characteristics of diagnostic X-ray machines and recording systems, geometrical relationships, X-ray spectra, information limits, optical physiology and performance, special techniques such as magnification and cine radiography, and computerized tomography. Radiation protection is also covered, with an emphasis on patient dose.

Environmental Health Sciences 285a,b. Physics of Nuclear Medicine

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Bjarngard, Mr. Zimmerman.

Given alternate years; to be given in 1978-79.

This course covers the physical and chemical aspects of production, properties and standardization of radionuclides and radiopharmaceuticals, including cyclotron production of short-lived isotopes. Also discussed are instrumentation (e.g., scanners, cameras, proportional counters, the positron camera) and computer applications involving dynamic and regional function analysis, radionuclide tomography, and image processing. The measurement of calcium in bone is also covered.

Environmental Health Sciences 286c,d. Physics of Radiation Therapy

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units (2.5 units each period).* Dr. Bjarngard.

Given alternate years; to be given in 1978-79.

This course deals with the mathematics of treatment planning for external

beams, brachytherapy and radioactive nuclides, including computerized techniques. Also covered are accurate and precise dosimetry measurements for photons, electrons, protons, and neutrons, including calibration and quality control of machines and sources. Selected studies of current clinical problems are also presented. Either period may be taken separately.

Environmental Health Sciences 301-306a,b,c,d,e. Tutorial Programs
Reading or research. *Time and credit to be arranged.*
Reading or research assignments for individual tutorial work at a master's degree level are provided for qualified students in the fields of industrial hygiene, industrial ventilation, aerosol technology, radiological health, medical radiation physics, nuclear medicine, solid waste management, air pollution control, and environmental health management.

301 *Air Pollution.* Dr. Cooper, Dr. First, Dr. Leith, Dr. Spengler.
302 *Industrial Hygiene.* Mr. Burgess, Dr. Hinds, Dr. Smith.
303 *Radiological Health.* Dr. Moeller, Dr. Shapiro.
304 *Medical Physics.* Dr. Bjarngard, Dr. Webster.
305 *Solid Wastes.* Dr. First.
306 *Environmental Health Management.* Dr. Cooper, Dr. Moeller.

Enrollment is subject to the approval of the Head of the Department.

Environmental Health Sciences 350-360. Research
Facilities of the Department are available for doctoral candidates and properly qualified second-year master's degree students to pursue independent research on problems in industrial hygiene, aerosol technology, solid waste management, air pollution control, and radiological health. Areas currently receiving study in the Department are as follows:

351 Evaluation of performance factors of respiratory protective devices; monitoring exposures of occupational groups to toxic air contaminants; ventilation control of airborne contaminants; evaluation and control of noise *(Mr. Burgess, Dr. Smith).*

352 Application of gas- and liquid-phase reactions to particulate and gas removal; development and design of cleanup systems for airborne contaminants from industrial and nuclear power plant facilities; incineration of solid wastes including municipal, radioactive, biological, and laboratory materials *(Dr. First, Dr. Leith).*

353 Measuring and modeling the performance of industrial gas cleaning equipment; assessing the air pollution potential of simple and complex pollution sources *(Dr. Leith).*

354 Computer modeling of pollutant transport in urban atmospheres; analysis of air quality data derived from sampling networks; meteorology of urban areas *(Dr. Spengler).*

355 Experimental and theoretical research in aerosol generation, measurement, and behavior, with emphasis on the measurement and control of particulate air pollutants *(Dr. Cooper).*

356 Reduction of population dose from sources of natural origin; environmental protection for nuclear facilities; radiation safety criteria and standards *(Dr. Moeller).*

357 Sampling and analysis of aerosol particles both in the ambient atmosphere and under laboratory conditions; generation of monodisperse aerosols; uses of aerosols in environmental health; development of particulate removal equipment *(Dr. Hinds).*

358 Evaluation and control of hazards from radioactive contamination; radiation dosimetry *(Dr. Shapiro).*

359 Medical radiation physics with emphasis on dosimetry, nuclear medicine, and radiation therapy *(Dr. Bjarngard).*

360 Medical radiation physics with emphasis on survey techniques, instrumentation, and image quality and patient dose reduction in diagnostic radiology *(Dr. Webster).*

Enrollment is subject to the approval of the Head of the Department.

DEPARTMENT OF EPIDEMIOLOGY

Brian MacMahon, M.B., Ch.B., D.P.H., Ph.D., S.M. in Hyg., M.D., Henry Pickering Walcott Professor of Epidemiology and Head of the Department

Faculty: Professors Hutchison, Miettinen, and Morrow; Associate Professors Cole, Monson, and Rothman; Assistant Professor Morrison; Lecturer Ellison

Teaching and Research Staff: Lecturers and Visiting Lecturers Feinleib, Jick, Li, Miller, Paffenbarger, Sartwell, and Wyshak; Research Associates Finkle and Yen

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The major objective of the Department of Epidemiology is to provide opportunities for training and experience in the application of epidemiologic research methods to the investigation of diseases of unknown etiology. Emphasis is on the cardiovascular and mental disorders, the malignant neoplasms, abnormalities of reproduction and development, and other major diseases for which preventive measures are still unknown or inadequate.

One- and two-year research training programs lead to the degree of Master of Science in Epidemiology. (For a description of these programs, see the section entitled "Admission and Degree Requirements and Academic Programs.") For qualified students the period of research training may be extended by admission to either of the doctoral programs offered by the School, by admission to special student status, or through other individual arrangements. Most of the training period beyond the master's degree is occupied in supervised research experience. Potential doctoral candidates must plan at least two years in residence beyond completion of the master's degree.

A three-year residency in the Department of Epidemiology has been approved as satisfying residency requirements of the American Board of Preventive Medicine for certification in General Preventive Medicine. Requirements of the approved residency and of the School's degree programs may be satisfied simultaneously.

Epidemiology 201a. Principles of Epidemiology

Lectures, seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Monson, Dr. MacMahon.

This course consists of lectures and seminars on the purposes, principles, and methods of epidemiology, defined as the study of the distribution and determinants of disease frequency in man. The principles discussed serve as an introduction to many aspects of the prevention and control of disease in populations. Illustrations include classic and contemporary studies of acute and chronic disease.

Epidemiology 202b,c. Epidemiology Seminars

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Morrison, Staff of the Department.

This course is intended as an extension of Epidemiology 201a. Principles and methods presented in 201a are considered in the context of substantive issues. Seminars will be oriented to areas of interest to enrolled students. Each student will make one or more presentations, based on a study design or a review of one or more papers in a substantive area.

Prerequisites: Epidemiology 201a and Biostatistics 101a. Enrollment is limited and is subject to the approval of the instructor.

Epidemiology and Biostatistics 203b. Principles of Epidemiologic Research I: Problem Conceptualization and Study Design

Lectures, seminars. *Two 2-hour sessions each week. 4 units.* Dr. Miettinen. With a detailed text in the background, the course utilizes simple examples and other illustrations to introduce the objects of epidemiologic research and the goals, options, and decision principles in study design. (A parallel tutorial course is available for those desiring in-depth study.)

Prerequisite: Epidemiology 201a.

Epidemiology and Biostatistics 203c. Principles of Epidemiologic Research II: Data Analysis and Inference

Lectures, laboratory. *Two 2-hour sessions each week. 3 units.* Dr. Miettinen.

Again with a detailed text in the background, the course exploits examples from actual studies to introduce the principles of hypothesis testing and estimation in epidemiologic research. (A parallel tutorial course is available for those desiring in-depth study.)

Prerequisite: Biostatistics 101a,b.

Epidemiology and Biostatistics 204c,d. Principles of Epidemiologic Research III: Applications

Tutorials, seminars. *Tutorial sessions during third period; one 2-hour seminar each week during fourth period. 2.5 units.* Dr. Rothman.

The seminars consist of student presentations of plans for and analyses of epidemiologic data, with discussion by students and faculty. Preparatory work is done under tutorial arrangements with members of the faculty. For the analyses, the emphasis will be on conceptual issues and not on execution.

Prerequisites: Epidemiology and Biostatistics 203b or Epidemiology 206b.

Epidemiology 205c,d. Topics in Epidemiologic Research

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Hutchison, Staff of the Department.

This course is intended for students who expect to conduct epidemiologic research. It consists of lectures on topics that are not part of the basic

methodology covered in other courses in the Department. Topics include sampling, factors affecting response, data handling, analysis of time-place clustering, cyclic variation, survival, and problems of distinguishing genetic and environmental components of a disease.

Prerequisites: Epidemiology 201a and Biostatistics 101a,b, or equivalent.

Epidemiology 206b. Epidemiologic Methods

Lectures. *Two 2-hour lectures each week. 2.5 units.* Dr. Rothman, Staff of the Department.

This course is intended for students at the master's level who wish to acquire a familiarity with procedural and quantitative aspects of epidemiology. Study and program design will be presented, as will methods of analysis and interpretation. Effort will be made to emphasize concepts of practical value.

Prerequisite: Epidemiology 201a or equivalent.

Epidemiology 211c,d. Epidemiology of Chronic Disease

Lectures. *Each module requires one 2-hour session each week for one period. 1.25 units per module; 5 units if all modules elected.* Dr. Hutchison, Staff of the Department.

This course is a review of the epidemiology of chronic disease. It consists of four modules, any number of which may be elected. Two modules run in each period. The modules in the third period are: (1) cardiovascular and respiratory disease (Dr. Hutchison) and (2) cancer and screening (Dr. Cole). Those in the fourth period are: (3) diseases of the nervous and endocrine systems (Dr. MacMahon) and (4) effects of environmental exposures (Dr. Monson).

Epidemiology 213d. Epidemiology of Oral Diseases

Seminars. *One 2-hour session each week. 1 unit.* Dr. Rothman.

Given alternate years; to be given in 1977-78.

This course is intended for dentists with an interest in dental epidemiology, including surveys and clinical trials. The epidemiology of oral diseases is reviewed, and methodologic problems intrinsic to dental research are discussed. Participants are invited, but not required, to present an original study design for critical review. Topics to be covered include dental caries, periodontal diseases, oral cancer, malocclusion, and indices of oral health.

Enrollment is subject to the approval of the instructor.

Epidemiology 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Students may participate in departmental research in close association

with a staff member. Time and credit are to be arranged with the Head of the Department.

Epidemiology 350. Research

In selecting topics for research in doctoral programs, students should consider the fields in which members of the Department are currently working. These include:

Neoplastic disease (*Dr. MacMahon, Dr. Cole, Dr. Hutchison, Dr. Monson, Dr. Morrison*).

Congenital malformation (*Dr. MacMahon, Dr. Miettinen, Dr. Rothman, Dr. Yen*).

Cardiovascular disease (*Dr. Rothman, Dr. Miettinen*).

Effects of contraceptive agents (*Dr. Cole, Dr. Rothman*).

Environmental epidemiology (*Dr. Monson*).

Statistical methods (*Dr. Miettinen*).

DEPARTMENT OF HEALTH SERVICES

Robert J. Haggerty, A.B., M.D., Roger Irving Lee Professor of Public Health (Health Services and Pediatrics) and Head of the Department

Faculty: Professors and Visiting Professors Berry, Binstock, Curran, Densen, Diamond, Roberts, Valadian, Wray, Yerby, and M. Young; Associate Professors Hsiao, Nesson, D. Neuhauser, and Sahney; Assistant Professors Feldman, Fineberg, Palmer, Stason, Thompson, and D. Young; Lecturers Braun, Chase, Dwyer, Joseph, Kasten, Sherman, Strong, Trevelyan, and Yacovone

Teaching and Research Staff: Lecturers and Visiting Lecturers Allen, Alpert, Atamian, Bander, Barkin, Berarducci, Blumenthal, Boland, Cash, Cohn, Coombs, Cotton, Dodds, Dolinsky, Dooley, Dull, Earls, Entmacher, Levin-Epstein, Field, Fox, Gold, Hassan, Hemenway, Hobart, Irish, Kelly, Komaroff, LaCasse, Lesser, Levine, Liljestrand, Lion, Lorch, MacLeod, Martikainen, McLerran, Mechling, Medina, Messenger, Morris, E. Neuhauser, Newberger, Nolan, Rockoff, Rosenberg, Ryan, Shapiro, Shepard, Silberman, Silversin, Simon, Storm, Taylor, Wathne, White, and Yankauer; Instructors D. Barrett, Berwick, and Dumbaugh; Research Associates R. Butler, S. Thomas, Walker, and Winsten; Consultants Janeway and Livernash

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The goal of the Department of Health Services is to improve health care through education of future leaders in health services and through programs of research in developing and evaluating new community health systems. The Department offers two major areas of program specialization — health services administration and maternal and child health. These two areas represent the two departments which were combined to create the current Department of Health Services. A third department, the Department of Behavioral Sciences, is functioning for administrative purposes within the Department of Health Services; specialized programs are also offered in this area. Courses in the areas of health services administration and maternal and child health are described below; courses in the area of behavioral sciences are described under "Department of Behavioral Sciences."

Although students may concentrate in any one of these areas, the emphasis of the Department is upon the holistic nature of health services, including mental health services and services for special groups such as the handicapped, mothers and children, and the aged. The many disciplines relevant to health services are represented in the faculty — medicine, economics, law, political science, anthropology, psychology, sociology, public and business administration, and health education. Since the development of health policy, management of health systems, and development and evaluation of health services involve many academic disciplines, students may take courses in

other parts of the University, such as the Medical School and schools on the Cambridge campus, to augment courses given at the School of Public Health.

In addition to the programs offered in the three areas listed above, the Program in Health Policy and Management (described on page 40), as well as the Executive Programs in Health Policy and Management (described on page 18), are integrated with the Department of Health Services through faculty appointments. The former is an interdisciplinary two-year program which leads to the degree of Master of Science. It is based on core courses listed under "Interdepartmental Courses" and under "Division of Health Services Administration" (of the Department of Health Services). In addition to these and other courses offered by the School of Public Health, students may select appropriate courses offered by other faculties at Harvard and by the Massachusetts Institute of Technology. The Executive Programs in Health Policy and Management offers a series of nondegree programs designed to provide continuing education in health management, policy, planning, and regulation for executives involved in health care.

Division of Health Services Administration

The increasing complexity of medical services calls for diverse types of health organizations. The growth of organized health services has created an increased need for qualified administrators and researchers. A major goal of the division of health services administration is to provide education for leadership in health service organizations. Emphasis is placed on planning, organization, evaluation, and regulation of health services.

Special attention is given to macroadministration or the administration of health systems. Cross-national studies of health care systems are used as analytic tools to assist the student in gaining an appreciation of the universal nature of the determinants that govern organized activity for the delivery of health services.

Consideration is given to traditional administrative techniques as well as more recently developed quantitative and analytic methods. Since many problems, broad in scope, must be studied, the resources of multiple disciplines and several Harvard faculties are carefully integrated into the program.

The division participates in programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (For a description of the one-year program leading to the degree of S.M. in Health Services Administration, see the section entitled "Admission and Degree Requirements and Academic Programs." A two-year interdisciplinary program leading to the degree of S.M. in Health Policy and Management is also offered, and is described in that same section.)

Health Services Administration 201b,c. Health and Social Welfare Systems in Cross-National Perspective

Lectures, seminars, case discussions. *Two 2-hour sessions each week. 5*

units. Dr. Yerby, Dr. Dieter Koch-Weser (Associate Professor of Preventive and Social Medicine, Harvard Medical School).

Modernization and industrialization have affected the health and economic security of individuals and families. Cyclic unemployment, industrial accidents and disease, temporary and permanent disability, and the social and financial deficits of old age are among the problems of modern nation states. The course examines the mechanisms that have evolved in different societies to ameliorate these hazards. The interrelatedness of health and social welfare programs and services is explored.

Health Services Administration 202b,c,d. Seminar in Health Services

Seminars. *One 2-hour session each week. 3 units (1 unit each period).* Dr. Haggerty, Staff of the Division.

This course is for persons concentrating in the Department of Health Services. It will be focused on current issues in health services.

Health Services Administration and Behavioral Sciences 203a,b. Administration and Organization of Health Services

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units each period.* Dr. Benfari, Dr. Neuhauser.

This course describes the character and the function of the managerial process in health organizations. The "a" period focuses on leadership, group process, motivation, and communication. The "b" period focuses on organizational design, control, and information systems. Either period may be taken separately.

Health Services Administration 205a,b; 205c,d. Health Education

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Young, Staff of the Division.

This course is designed primarily for program administrators and emphasizes major aspects of learning theory, communication theory, educational methods, and health behavior; health education in the process of social change; psychosocial and cultural factors relevant to planning of health education programs; and research and evaluation in health education.

The course is repeated in the third and fourth periods.

Health Services Administration 206c,d. Health Law, Public Policy, and Consumer Protection in the Health Field

Seminars. *One 2-hour session each week. 2 units.* Dr. Curran.

This course covers the application of law and legislative process to the establishment of public policy in health fields such as medical care delivery systems, health manpower, and consumer protection. Special attention is given to regulation of quality in health care, consumer involvement,

and equality of access to health systems. A case analysis method is employed.

Health Services Administration 207a,b. Dental Public Health Practice

Seminars, field visits. *One 2-hour session each week. 2.5 units.* Dr. Yacovone.

This seminar provides in-depth training in the administration and planning of dental health programs. Subjects covered include community needs, resources, surveying, fluoridation, prepayment, and program evaluation. Each student develops a program plan in a specific area of community dental needs and presents the plan to the class.

Population Sciences and Health Services Administration 207c,d. The Design and Management of Population Programs

Case discussions, seminars. *Two 2-hour sessions each week. 5 units.* Dr. D. Korten, Dr. F. Korten, Dr. Wyon, Staff of the Department of Population Sciences.

(Course is described under Department of Population Sciences.)

Health Services Administration 208a,b. Economic Analysis

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Berry, Dr. Hemenway

This course is an intoduction to microeconomic analysis, with the goal being for students to understand the way economists approach problems, to become comfortable with simple microeconomic models and concepts, and to recognize their uses and limitations. The course is largely a "tools" course and should provide a solid understanding of such economic concepts as "opportunity cost," "externalities," and "marginal analysis."

Required for students in the Health Policy and Management Program.

Health Services Administration 208c,d. Economics of Health Care

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Berry, Dr. Taylor.

This course is designed to provide an examination of the economic aspects of the production, distribution, and organization of health services. The course is devoted to applying the framework of economic analysis to the health services sector. Topics normally covered include the supply and demand of medical care facilities, markets for health manpower, financing of medical care, cost-benefit analysis, and problems of health planning.

Prerequisite: Interdepartmental 210a,b or equivalent.

Required for students in the Health Policy and Management Program.

Health Services Administration 209c,d. Economics of Health Planning

Seminars. *Two 1½-hour sessions each week. 5 units.* Mr. Hsiao.

This course applies economic analysis to planning of health programs. Application is emphasized over theory. The course examines planning and regulation in a market economy, and develops analytical tools including econometrics, modeling, simulation, and cost-benefit analysis. Planning topics include health manpower, resource allocation, hospital facilities, and national health insurance. Skills in using analytical techniques appropriately are developed. Case study material is used.

This course is especially appropriate for students who intend to pursue a career in planning and evaluation of health programs.

Prerequisites: One semester each of statistics and microeconomics.

Health Services Administration 210d. The Health Maintenance Organization: Exploring an Alternative Care System

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Nesson, Mr. Simon.

Recent national concerns with improving health care have promoted the HMO as an alternative care system. This course explores the background of this movement, its liabilities and progress, and the evolving legislation. Reading and materials are taken from operating plan experiences. A seminar format is used. The students, working in groups, will prepare proposals for the organizational, marketing, financial, and delivery programs of a newly developing HMO.

Health Services Administration 211c,d. Administration of Personal Health Service Programs

Seminars, field projects. *One 2-hour session each week. 2 units.* Dr. Kasten.

This course is designed for students who will be administrators of personal health service programs. Inpatient, ambulatory, home, and rehabilitation programs are treated from an operational and preventive perspective. Special emphasis is placed on administrative problem solving. Students analyze administrative problems in operating personal care service programs.

Enrollment is subject to the approval of the instructor.

Health Services Administration 215c,d. An Introduction to Ambulatory Care Administration

Seminars. *One 2-hour session each week. 2.5 units.*

Not given in 1977-78.

This course deals with the concepts, problems, and issues involved in the administration of ambulatory care programs. Comparative models such

as outpatient departments, neighborhood health centers, and group practice are discussed, including organization, operations, and manpower.

Prerequisite: Health Services Administration and Behavioral Sciences 203a,b, or permission of the instructor.

Biostatistics and Health Services Administration 216c,d. Health Program Evaluation

Lectures, discussions. *One 2-hour session each week. 2 units each period. 216c may be taken without 216d.* Mr. Frazier, Dr. Reed.

(Course is described under Department of Biostatistics.)

Health Services Administration 217d. Issues in the Design and Implementation of Government Programs

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Feldman.

This course analyzes the social choices which are inherent in government programs in the health field and their implications for social change. Cases are drawn primarily from planning and regulatory programs at the federal and state levels in the United States.

Health Services Administration 218c,d. The Sociology of Medical Care

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Staff of the Division.

This course is organized along two major axes: (1) the importance of social factors as they bear on health and illness and as they affect the health care system; (2) the microsociological (clinical) and the macrosociological (societal) aspects of illness and its treatment. It is proposed to expose the students to clinical situations so that they will better understand the basic elements of the interaction between patients and health professionals.

This course or an accepted alternative is required for students in the Health Policy and Management Program.

Health Services Administration 220d. Quality Assurance in Health Services

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units.* Dr. Palmer, Visiting Lecturers.

This course examines issues in defining "quality in health care" and the choice of methods for assessing and improving quality of health care. Recent research is reviewed and currently operating programs, including PSROs, are analyzed. Presentation includes case materials from quality assurance programs in both hospital and ambulatory settings.

Health Services Administration 244a,b. Political Analysis in Health Care (Public Policy 244)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Fineberg.

This course presents an introduction to political and bureaucratic considerations which affect the outcome of health programs. The course should improve the student's ability to predict the likely consequences of departmental, agency, institutional, and individual actions. It should also improve the student's ability to plan more effective implementation of health programs. The course is appropriate for students who will be involved in planning, initiating, and managing health programs.

This course or an accepted alternative is required for students in the Health Policy and Management Program.

Health Services Administration and Biostatistics 290c. Analysis of Health and Medical Practices (Public Policy 290)

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Dr. Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).

This course concerns the analysis of clinical procedures and health programs, and examines uses and limitations of quantitative methods such as decision analysis and cost-benefit analysis. Topics include: resource allocation in the management of hypertension; treatment decision for acute abdominal pain; diagnosis of renovascular disease; screening for glaucoma; coronary artery bypass surgery. Implications for quality assurance and medical reimbursement policies are considered.

Prerequisite: Some facility with quantitative methods, preferably with some elementary knowledge of statistics, decision analysis, or economics.

Health Services Administration 295c,d. Economic and Administrative Issues in Medical Care (Economics 2950b)

Seminars. *One 2-hour session each week. 4 units.* Dr. Berry, Dr. Osler Peterson (Professor of Preventive Medicine, Harvard Medical School).

This seminar is concerned with the major issues of the medical care sector. During the first half of the course specific attention is given to issues of access to services, quality of care, and costs and inflation in the health sector. Alternative health care systems and planning are also considered. During the second half of the course student groups present their analysis of a specific significant issue in health or medical care. Throughout the course there is an emphasis on policy analysis.

Health Services Administration 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Students may make arrangements to do individual and group work under the guidance of a staff member of the division. This work can include readings and special projects. In addition, field assignments to federal, state, and local government and to private health organizations can be arranged.

301 *Doctoral Seminar.* Dr. Berry.

302 *Research in Health Education.* Dr. Young, Staff of the Division. This tutorial aims to assist doctoral students and others interested in research methodology in health education to understand the elements of research design and to apply these elements in analyzing a number of research projects and in developing original research proposals. Special emphasis is given to evaluation research.

303 *Dentistry and Social Policy.* Dr. Yacovone.

305 *Seminar in Health Manpower Analysis.* Dr. Wechsler, Staff of the Division.

315 *Applied Research Seminar.* Dr. Fineberg, Staff of the Division. Required for students in the second year of the Health Policy and Management Program.

316 *Special Projects in Health Services Administration.* Dr. Neuhauser.

Health Services Administration 330e. Assignments to Field Agencies
One-week period between fall and spring terms. 1 unit.
Students are assigned to work on special projects, such as group surveys, other types of field projects, or observation of and limited participation in the work of health agencies. Field assignments are made on an individual basis to meet the special needs of each student insofar as possible. Work in the field is coordinated with courses in the division.

Health Services Administration 350. Research
Doctoral candidates may register for Health Services Administration 350 to undertake individual study and research.

Division of Maternal and Child Health

The division of maternal and child health is concerned with education and research in health services for mothers and children as a part of general health services and as they relate to other service systems (especially social services and education). Planning for the delivery of personal health and social services to mothers and children depends upon knowledge of:

1. The aspirational values which society places upon them, their special

vulnerability to biological and environmental hazards, and the successive phases of biological change (growth and development);
2. The social situation and the way in which social services function as they affect the health of children and influence the child-care capability of families;
3. The health aspects of centers of early childhood education, and traditional and innovative practices in elementary and high schools.

The courses and tutorial work offered by the division are focused on actions which these characteristics demand for planning, administration, and evaluation of health care services. Maternal and child health services at international, national, and local levels, including services for handicapped children, are discussed in terms of integration with related health services in the community. In connection with this focus, the important roles of national governments, local health agencies, voluntary organizations, and community consumer groups are considered in seminars, observations of service programs in operation, or study of reports of such programs, foreign as well as domestic.

The division participates in the programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (For a description of the program leading to the degree of S.M. in Maternal and Child Health, see the section entitled "Admission and Degree Requirements and Academic Programs.") Fellowships are available for U.S. students who are concentrating in maternal and child health.

Maternal and Child Health 101. Child Growth and Development

Self-instructional course. May be taken any period. 2.5 units. Dr. Valadian. Individualized instruction in the physical growth, development, and maturation of children is presented in self-paced programmed material, supplemented as needed by conferences. The course covers topics which are necessary for advanced study of growth and development and which are basic for students who plan to be involved in medical or related social and educational services for children.

Maternal and Child Health 201b, 201c. Child Growth and Development II: Advanced Seminar

Seminars. *One 2-hour session each week. 2.5 units (or 1.5 units if only one period elected).* Dr. Valadian.

This advanced seminar deals in depth with the physical growth and development and the maturation of children ("b" period) and with the factors affecting them ("c" period). Either period may be taken separately. A term paper is required.

Prerequisite: Maternal and Child Health 101 or permission of the instructor.

Maternal and Child Health 202b. Primary Maternal and Child Health Care

Seminars, field visits. *One 2-hour session each week. 1 unit.* Dr. Haggerty, Dr. Valadian, Staff of the Division.

Seminars and field observations focus on four different health programs in Boston. Faculty members participate in the visits and seminars, which are intended to relate the observed activities to maternal and child health and to crippled children's programs.

Maternal and Child Health 203b. Content of Maternal and Child Health Services

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Haggerty, Dr. Valadian, Dr. Neuhauser, Staff of the Division, Guest Lecturers.

Components of health care services to mothers and children are discussed as they vary to meet the changing needs resulting from growth and maturational processes. Health services appropriate to maternity, early and late childhood, adolescence, and youth are presented in terms of the multidisciplinary and interdisciplinary action they require.

Prerequisites: Completion of Maternal and Child Health 101, simultaneous enrollment in Maternal and Child Health 201b, or permission of the instructors.

Maternal and Child Health 204c,d. Programs and Issues in Maternal and Child Health Services

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. Haggerty, Dr. Valadian, Dr. Neuhauser, Staff of the Division, Guest Lecturers.

Beginning with the historical background and the relationship of maternal and child health programs to social, mental health, education, and other systems, the course discusses factors which shape current and future maternal and child health policies and services. It considers the organization and administration of national, state, and local maternal and child health and handicapped children services and examines selected issues such as child abuse, lead poisoning, and day care.

Prerequisites: Maternal and Child Health 201b and 203b or permission of the instructors.

Maternal and Child Health 205d. Research Approach to Growth, Development, and Health of the Child

Seminars. *Two 2-hour sessions each week. 2 units.* Dr. Valadian, Dr. Reed.

Methods of obtaining and evaluating data on child growth, development, and health, and the construction of norms are studied, including the design of studies dealing with interrelationships among various aspects of the child's progress, background, and environment.

Enrollment is subject to the approval of the instructor.

Maternal and Child Health 206c,d. Maternal and Child Health in Developing Countries

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Joseph, Dr. Wray, Miss Cohn.

Using readings, discussions, and case presentations, this course considers issues of high priority in the health of mothers and children in developing countries, placing particular emphasis on the interactions between health and poverty in societies in rapid social and cultural transition. This course complements, but is not a substitute for, the issues raised in Interdepartmental 209a,b. Considerable reading is required to fulfill the course objectives.

Maternal and Child Health and Nutrition 207c,d. Nutrition in Child Growth and Development

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers.

Principles and practical problems encountered in the nutritional aspects of child growth and development are examined. Lectures on general principles are designed to help students base their judgments on scientific evidence. Discussions deal with a variety of nutrition case studies and simulations illustrative of problems in both developing and highly industrialized countries.

Maternal and Child Health 208c,d. Rural Health Services

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Joseph, Miss Cohn, Dr. Wray, Dr. Wyon.

Discussion focuses on the characteristics of "rural culture" and on problems in identifying and providing for the health needs of isolated communities. Five areas of concern are examined: Appalachia, the black South, migrant workers, Indian health, and the rural not-poor. However, the concepts discussed are pertinent to developing countries as well as the United States. After covering common issues, students work in small groups focusing on selected areas of interest. Field visits can be arranged.

Maternal and Child Health 300b,c,d,e. Tutorial Programs

Time to be arranged. 2 or more units.

Students may arrange to undertake an individual project or specialized reading under faculty supervision. Possible topics include: planning and evaluating health care services for mothers and children; public health nursing in family and community health programs; health services in rural sections of the United States and/or in developing countries; child growth and development. Advance approval by the Head of the Department of Health Services is required.

301 *Group Tutorial in Development Planning.* Dr. Joseph.
This group tutorial is given jointly with groups from the Graduate School of Education, the School of Design, and the Department of Economics, through the Harvard Institute of International Development. It involves a semester-long case study in multidisciplinary development planning.

Maternal and Child Health 330. Field Study
One-week period between fall and spring terms. 1 unit.
Field study is available in: (1) Puerto Rico (in cooperation with the Department of Human Development, School of Public Health, University of Puerto Rico) to observe regionalized programs in maternal and child health, for handicapped children, and in family planning; and (2) North Carolina and other rural areas, to observe rural health programs for mothers and children. Enrollment is limited and requires approval of the Head of the Department of Health Services *before the end of the first period.*

Additional Field Study
Students who lack sufficient previous experience are encouraged to undertake a period of field study before registration or after completion of the academic year, in a program arranged by the staff of the division. No credit is allowed for such field study.

Maternal and Child Health 350. Research
Doctoral students may undertake research in maternal and child health by arrangement with the Head of the Department of Health Services.

DEPARTMENT OF MICROBIOLOGY

Jan Cerny, M.D., Ph.D., Associate Professor of Immunology and Acting Head of the Department

Faculty: Professors Murray and Nichols; Associate Professors Cerny, Essex, MacDonald, and Vinson; Assistant Professors Fraser, Grant, Herrmann, and Modabber; Lecturers Lambe and Madoff

Teaching and Research Staff: Visiting Lecturers Fiumara, Gilfillan, Grady, and Wright; Instructor M. Benfari; Research Associates Cotter, Eisenstadt, Girard, Greenberger, and Stiller; Assistants McComb, Rota, and Spielman

Infectious diseases remain a major health problem in both developed and underdeveloped countries. Microbiologists must be concerned not only with prevention and treatment but with policy formation, administration, and research if the problems of infectious disease are to be solved. In conjunction with the Department of Tropical Public Health in the Center for the Prevention of Infectious Diseases, the Department of Microbiology provides education for leadership in control of infectious diseases. Emphasis is placed on decision making in diagnostic and surveillance programs; judging the uses and limitations of public health systems; and study of fundamental microbiological and immunological problems related to infectious disease. The deleterious effects of infectious disease, for the individual or for the community, are related to changing political, social, and economic patterns which impinge on the microbe-host relationship.

A major objective of the Department is to train students to think of infectious disease in the context of epidemiology. Advances in immunology have extended the scope of inquiry required of microbiologists to autoimmune disorders, hypersensitivity phenomena, variations in host response, cancer, and immunological surveillance mechanisms.

Candidates for the degree of Master of Science in Microbiology must demonstrate competence in microbiology and immunology; they must understand the problems and opportunities in the control of infectious disease in developed as well as underdeveloped countries. A minimum of 20 credit hours of formal course work offered or approved by the Department will satisfy this requirement, together with any additional courses suggested by the student's adviser within the Department, in the School, or in nearby academic institutions. The remainder of the program may be taken as additional formal courses, tutorials, or supervised research. Detailed information on degree programs offered by the Department may be found in the section entitled "Admission and Degree Requirements and Academic Programs."

The Department offers programs leading to the degrees of Doctor of Public

Health or Doctor of Science. Qualified students interested in research training may be admitted to either of these programs. During the first year of a provisional doctoral candidacy, students are expected to enroll in advanced courses in microbiology, immunology, and related fields in the School of Public Health, the Harvard Medical School or other areas of Harvard University, or the Massachusetts Institute of Technology. Doctoral candidates must plan at least one year in residence beyond completion of the master's degree. Most of the training beyond the master's degree is occupied by completion of a research project and preparation of a thesis.

The Department maintains close liaison with the Harvard Medical School and with several Harvard-affiliated hospitals. It houses the Center for Study of Sexually Transmitted Diseases funded by the National Institutes of Health; other units in this Center include the Department of Tropical Public Health; the Channing Laboratory for Infectious Diseases, Harvard Medical School; and the Infectious Disease Unit, Peter Bent Brigham Hospital. Research in less developed countries has been a strong component of this Department's programs for the last three decades.

Tropical Public Health and Microbiology 201a,b. Ecology and Epidemiology of Infectious Diseases

Lectures, seminars, demonstrations; laboratory elective. *Four 1-hour sessions and one 2-hour elective laboratory session each week, first period; one 1-hour session and two 2-hour sessions each week, second period. 5 units; 6 units if laboratory elected.* Dr. Weller, Dr. Nichols, Staffs of the Departments.

(Course is described under Department of Tropical Public Health.)

Microbiology and Tropical Public Health 202b. Critiques of Current Literature on Infectious Diseases

Seminars. *One 2-hour session each week. 1 unit.* Dr. Chernin, Dr. Herrmann, Staffs of the Departments.

Papers on topics of general interest are selected from current periodicals and critically reviewed as to soundness of experimental design, validity and significance of results and conclusions, organization of manuscripts, and clarity of presentation.

Enrollment of nondepartmental students is subject to the approval of the instructors.

Microbiology 203d. Clinical Problems in Infectious Diseases

Lectures, clinics. *One 2-hour session each week. 1 unit.* Dr. Louis Weinstein (Visiting Professor of Medicine, Harvard Medical School).

Problem cases concerning diagnosis, treatment, and control of the common acute communicable diseases of temperate climates are presented, together with discussions of infectious diseases that are usually not considered communicable.

Microbiology 204c. Public Health and Laboratory Aspects of Infectious Diseases of Microbial Origin

Seminars, laboratory exercises. *Two 3-hour sessions and one 1-hour session each week. 2.5 units.* Dr. Herrmann, Dr. Murray, Dr. Nichols, Dr. Essex, Ms. Rota, Staff of the Department.

Primary orientation is toward the epidemiologist. Students perform in detail cultural, immunological, and biochemical techniques, e.g., toxin assays, immunofluorescence, complement fixation, and neutralization tests. Viruses, bacteria, and rickettsiae are inoculated into embryonated eggs, tissue culture, and animals for study of immunologic or growth characteristics.

Enrollment is limited; prior approval of the instructors is required.

Microbiology 207a. Fundamentals of Immunology

Lectures. *Three 1-hour sessions each week. 2.5 units.* Dr. MacDonald, Dr. Cerny, Dr. Fraser.

Not given in 1977-78.

This course explores the fundamental principles of immunology and host defense mechanisms. Many aspects of immunology will be studied, including humoral and cellular phenomena.

The course is intended to allow those individuals with no previous exposure to the field to become acquainted with essential principles; it will serve as a review for those wishing to expand their knowledge of immunology or reappraise their attitudes in a burgeoning field.

Microbiology 208b. Immunology of Infectious Diseases

Lectures, seminars. *Two 1-hour sessions each week; discussion sessions to be arranged. 2.5 units.* Dr. MacDonald, Dr. Cerny.

A number of diseases are selected for discussion from an immunological point of view, and their host defense mechanisms are studied. Examples include immunology of mucosal surface infections such as gonorrhea, trachoma, or cholera; pathogenesis of antigen-antibody complexes in streptococcal infections; immunology of malaria, cancer, and tuberculosis; problems associated with mycotic infections; and host defense mechanisms to smallpox and measles.

Microbiology 209b. Laboratory in Immunology

Laboratory. *Two 3-hour sessions each week. 2.5 units.* Dr. MacDonald, Dr. Cerny, Dr. Fraser, Ms. Rota.

The laboratory consists primarily of recently developed techniques which can be utilized in the study of infectious diseases. These techniques will include isolation and modification of antigens, radio-immunoassay, immunoplaque assay, isolation of antibodies, fluorescence labeling, im-

munoabsorption, phagocytosis, migration inhibition factor, blast transformation, virus neutralization, and complement fixation.

Enrollment is limited; prior approval of the instructors is required.

Microbiology 211b. Medical Mycology

Laboratory, conferences, field exercises. *One 3-hour session and 3 hours of individual laboratory work each week. 2 units.* Staff of the Department.

Not given in 1977-78.

This course introduces physicians and microbiologists to laboratory and field research and to clinical studies in medical mycology. No prior knowledge of the mycoses is assumed.

Enrollment is subject to the approval of the instructor.

Microbiology 213d. Intracellular Microorganisms Pathogenic for Man

Laboratory exercises, seminars. *Two 3-hour sessions each week. 2 units.* Dr. Herrmann, Dr. Murray, Dr. Nichols, Ms. Rota, Staff of the Department.

This course provides an understanding of the techniques available for studying the growth and the characteristics of representative strains of rickettsiae, chlamydiae, and viruses which are human pathogens. Under staff supervision, each student performs the procedures for identification and characterization of unknown pathogens.

Prerequisite: Microbiology 204c or equivalent. Enrollment is limited to 18 students with prior approval of the instructors.

Tropical Public Health and Microbiology 214c,d. Case Studies in Epidemiology of Infectious Disease

Seminars, laboratory exercises. *One 2-hour session each week. 2.5 units.* Dr. Hopkins, Dr. Langmuir (Visiting Professor of Epidemiology, Harvard Medical School), Dr. Nichols.

(Course is described under Department of Tropical Public Health.)

Microbiology 215d. Problems in Medical Bacteriology

Seminars, laboratory demonstrations. *One 3-hour session each week. 1 unit.* Staff of the Department.

Not given in 1977-78.

This course covers bacteriologic problems of particular interest to students which are not considered in Tropical Public Health and Microbiology 201a,b. Course content is assembled around the students' interests. The course is given only if the instructor receives at least six individual requests before the end of the second quarter.

Microbiology and Tropical Public Health 216d. Sexually Transmitted Diseases

Lectures, seminars. *One 2-hour session each week. 1 unit. Additional credit may be arranged.* Dr. Hopkins, Dr. Nichols, Guest Lecturers.

Discussion centers on why sexually transmitted diseases that are easily cured are out of control. Reviewed topics include pathobiologic, epidemiologic, and biosocial aspects of venereal diseases, such as patterns of sexual behavior, lay and professional attitudes toward venereal disease and patients, and legal and economic aspects of control. Interaction of students from both social and medical sciences benefits the examination of possible new approaches for dealing with the problems.

Microbiology and Tropical Public Health 217d. Virology

Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner.

The course is structured to provide students with fundamentals of human virology and introduces the new and relevant concepts emanating from recent and ongoing research. Topics include virus-host cell interaction, pathogenesis, chronic and latent infections, epidemiology, environmental factors, host defense mechanisms, and community control measures. Selected virus groups are discussed in detail.

Microbiology 218d. Anaerobic Bacteriology

Lectures. *Three 1-hour sessions each week.*

Laboratory demonstrations. *Three 3-hour sessions per term, to be arranged. 2.5 units.* Dr. Lambe.

This course presents a discussion of anaerobic bacteria, including isolation techniques from clinical specimens, taxonomy, metabolic pathways, identification methods, medical significance, antibiotic susceptibility, immunological characterization, and the host immune response.

Enrollment is limited and is subject to prior approval of the instructor.

Microbiology 300a,b,c,d. Tutorial Programs

Time and credit to be arranged. Staff of the Department.

Enrollment requires the consent of the staff member responsible for supervision of the research. The various subject areas are listed below by category.

302 *Rickettsiae.* Dr. Murray.

The biology, immunology, and epidemiology of typhus, Rocky Mountain spotted fever, scrub typhus, and trench fever may be studied in the laboratory or in field operations in Yugoslavia, Tunisia, Mexico, and Cape Cod, Massachusetts. Biologic systems include infected animals, chick embryos, cell cultures, human body lice, and oriental rat fleas. Immunology embraces immunoglobulin and cell-mediated immune responses and antigenic analyses of rickettsiae, as well as logic procedures and vaccines.

303 *Chlamydiae.* Miss McComb, Dr. Murray, Dr. MacDonald, Dr. Nichols.
Laboratory and field research in trachoma, inclusion conjunctivitis, psittacosis, lymphogranuloma venereum, and the diseases caused by the chlamydial agents in humans and animals. Students are welcome to do laboratory and, occasionally, field investigations.

304 *Viruses.* Dr. Essex, Dr. Herrmann, Dr. Cerny, Dr. Fraser.
Isolation and identification of representative viruses by use of cell culture, animal inoculation, and serologic techniques.

305 *Immunochemical Methods.* Dr. MacDonald, Dr. Herrmann.
Experiments with immunofluorescence, chromatography, immunoelectrophoresis, enzyme-coupled antibody, labeled isotopes, and other techniques applied to research on microorganisms and mechanisms of hypersensitivity.

306 *Public Health Laboratory.* Associates at the State Laboratory Institute.
The State Laboratory Institute is engaged in a variety of programs related to public health. These include the development, preparation, and testing of new and standard serums, vaccines, and blood fractions; research in various aspects of applied immunology; various aspects of diagnostic service in the fields of bacteriology, virology, and congenital metabolic disorders; and field studies on arboviruses. Individual arrangements for study can be made in any of these programs.

307 *Tumor Biology.* Dr. Essex, Dr. Cerny, Dr. Grant.
Approaches and techniques for the study of cancer as an infectious disease. Procedures used to study tumor cell and tumor virus marker antigens and antibodies are demonstrated. The significance of these markers for epidemiological, etiological, and diagnostic investigations of various tumor systems of known and unknown cause is discussed. The relationship between the immune response and the oncogenic process is also examined.

308 *Cellular Immunology.* Dr. Cerny, Dr. Essex, Dr. Grant.
Differentiation of cells producing antibody of various classes *in vivo* and *in vitro*. The studies involve the use of a number of immunological methods, but principally the agar plaque technique. The major experimental model utilized is immune response to cell wall antigens of *Vibrio cholerae*. The research also involves experiments on interaction between antibody-forming cells and leukemic viruses in mice and studies on mechanism of virus-induced immunosuppression.

310 *Venereal Disease.* Dr. Nichols, Dr. Murray.
The departmental research on venereal diseases, especially gonor-

rheae, and the chlamydial diseases spans biology, immunology, microbial physiology, and epidemiology. Student participation in ongoing project areas is encouraged.

311 *Health Problems in Selected Underdeveloped Countries.* Dr. Nichols.
Problems are studied in the historical context of their political, socioeconomic, and cultural development. Extensive reading assignments are discussed in small seminars. Students with experience in international health are preferred.

Microbiology 350. Research
Qualified doctoral candidates, research fellows, and full-time special students may register for Microbiology 350 to undertake original research in virology, rickettsiae, mycology, bacteriology, immunology, or in one of the disciplines available at the State Laboratory Institute. A number of the current research activities of the Department of Microbiology are indicated under Microbiology 300. Inquiries about specific research opportunities should be addressed to the Head of the Department.

DEPARTMENT OF NUTRITION

Robert P. Geyer, S.B., S.M., Ph.D., Professor of Nutrition and Head of the Department

Faculty: Professors Hegsted, Lown, Stare, and Timmer; Associate Professors Antoniades, Gershoff, Hayes, and Herrera-Acena; Assistant Professors Christiansen, Huber, el Lozy, Mora, Samonds, Thenen, Verrier, and Witschi; Lecturer Austin

Teaching and Research Staff: Visiting Lecturer Levinson; Research Associates Ausman, Boelkins, Chu, DeSilva, Gallina, Graboys, Kardonsky, Lynch, Miller, Nicolosi, Rabinowitz, Remmell, and Whelan; Consultants Cannon and McGandy; Assistants Bruno, Duffett, and Gallagher

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The Department of Nutrition is concerned with basic and applied investigations in the science of nutrition in the areas of biochemistry, physiology, pathology, and psychology. Many of these are oriented toward problems of contemporary public health importance, such as cardiovascular diseases, obesity, and diabetes. The Department is also concerned with the economic areas of nutrition, such as planning and applied interventions. The Department has had a long-standing interest in general nutritional and health problems in the United States and in various countries in South America, Africa, and Asia.

The core curriculum required of all master's students within the Department consists of the following courses: Public Health Nutrition; Nutrition Policy Formation and Program Operation; the Departmental Seminar; Biochemistry and Physiology of Nutrition; Principles of Epidemiology; Principles of Biostatistics; and a course in biochemistry. Students coming from relevant nonscience disciplines may have interests in applied nutrition areas. These students may not have the bioscience background to meet the biochemistry requirements of the Department. Nonetheless, they are viewed as an important constituency of the Department of Nutrition. Before filing a formal application, however, such potential students should contact the Department to discuss individual needs.

Nutrition 201a,b. Selected Topics in Public Health Nutrition

Lectures. *One 2-hour session each week. 2 units.* Dr. Gershoff.

The course deals with selected topics in human nutrition and the application of nutrition programs to public health. The course is concerned with nutrition problems of developing countries, such as nutritional deficiency diseases, famine, and the relationship of food and nutrition programs to socioeconomic development. It is also concerned with nutrition problems in industrialized countries, such as obesity, nutrition and cardiovascular disease, food safety, and nutrition programs in the United States.

Nutrition 202a,b. Public Health Nutrition

Lectures, discussion. *Two 2-hour sessions each week. 5 units.* Dr. Hegsted.

The development and evaluation of nutrition programs depends upon estimates of nutritional needs, evaluation of nutritional status, and identification of health problems related to nutrition. This course deals with methodologies for these purposes. Consideration is given to the collection and use of food and nutrient consumption and to biochemical, clinical, anthropometric, and demographic information. The application of these methods to problems which may require different methods of intervention is emphasized.

Nutrition 203c,d. Nutrition Policy Formation and Program Operation

Lectures, discussion. *Two 2-hour sessions each week. 5 units.* Dr. Austin.

This course deals with the formation of food and nutrition policies and the operation of nutrition intervention programs aimed at the major nutritional problems in the United States and in the developing nations. The course employs a multidisciplinary and case study approach to develop skills in analyzing and formulating nutrition policies and plans, and to sharpen problem-solving and decision-making capacities regarding nutrition program operation.

Prerequisite: Nutrition 202a,b or permission of the instructor.

Nutrition 204a,b,c,d. Departmental Seminar

Seminars. *Two 1-hour sessions each week. 4 units.* Dr. Thenen.

Students are expected to summarize and criticize recent publications in the general field of nutrition. Attention is placed on validity of experimental designs in nutritional research. Topics include the biochemical, physiological, behavioral, and clinical aspects of nutrition.

Nutrition 205c,d. Biochemistry and Physiology of Nutrition

Lectures, discussions, required reading. *Two 2-hour sessions each week. 5 units.* Dr. Hayes, Staff of the Department.

The biochemical and clinical aspects of the metabolism of carbohydrates, fats, proteins, vitamins, and essential minerals are considered in detail, with students actively participating in discussion of the material.

Prerequisite: A recent course in biochemistry. The course is intended for students majoring in nutrition but may be taken by others with consent of the instructors.

Nutrition 206c,d. Laboratory and Animal Research Techniques

Lectures, demonstrations. *One 3-hour session plus 2 additional hours each week. 5 units. Reduced credit may be arranged for students not majoring in nutrition.* Dr. Geyer, Dr. Antoniades, Staff of the Department.

By means of discussions, laboratory work, and tutorial instruction this

course affords the opportunity to learn the principles and practice of modern experimental animal and laboratory research techniques. The schedule is so arranged as to allow the student to simultaneously participate in a variety of ongoing research projects involving animals and/or mammalian cell cultures, and to conduct instrumental and noninstrumental laboratory procedures.

Maternal and Child Health and Nutrition 207c,d. Nutrition in Child Growth and Development

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers.

(Course is described under Department of Health Services.)

Nutrition 208c,d. Nutritional Aspects of Human Disease

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Herrera-Acena, Dr. el Lozy, Staff of the Department.

This course reviews the role of diet in the causation and management of clinical obesity, diabetes mellitus, coronary artery disease, anemia, and developmental retardation. Early detection and prevention of these nutrition-related disorders will also be considered.

Nutrition 209a,b. Food Science and Nutrition

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Mrs. Witschi, Dr. Samonds, Staff of the Department.

This course deals with nutrition in terms of the foods which supply mankind's nutrient needs, their composition and physical properties, and the positive and negative effects on nutrient qualities of food by genetic manipulation, agricultural practice, processing, storage, and cooking. The historical development of food technology, including methods of preservation and sanitation, is related to current methods employed in both developing and industrialized countries.

Nutrition 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Individual work, under direction, may be arranged for students at the master's level. This may include laboratory studies or projects in applied nutrition.

Nutrition 350. Research

Time and credit to be arranged.

Facilities are available for students at the doctoral level to do advanced work in nutrition along the lines of fundamental research or applied

nutrition in public health and medicine. Areas currently receiving intensive and comprehensive study in the Department are as follows:

Lipid metabolism in tissue culture cells; polyvalent metal metabolism in soft tissue; effects of CO_2 deprivation on tissue culture cells, parenteral nutrition, and artificial blood substitutes (*Dr. Geyer*).

The nutritive value of proteins and protein requirements; dietary effects on the metabolism of cholesterol in animals and man; the influence of diet on the metabolism of adipose tissue; nutritional requirements for calcium and for bone formation (*Dr. Hegsted*).

Coronary artery disease; etiology of sudden death; derangements of the heart beat; exercise physiology; electrolyte metabolism (*Dr. Lown*).

The effect of nutrition and other environmental factors on the etiology of heart disease in man; nutrition education; fluoride in human nutrition as a preventive for tooth decay and osteoporosis (*Dr. Stare*).

Measuring and predicting the nutritional impact of government policies, particularly non-nutrition policies; the formation and evolution of rice policies in Asia; rural development (*Dr. Timmer*).

Protein isolation and characterization; hormone biochemistry and metabolism (*Dr. Antoniades*).

The effects of nutritional deficiencies on endocrine metabolism; the etiology of urolithiasis in experimental animals and man; vitamin metabolism; interrelationships between nutrition and endocrine function (*Dr. Gershoff*).

Nutritional pathology with specific interest in lipid metabolism, atherosclerosis, and the fat-soluble vitamins (*Dr. Hayes*).

Endocrine, nutritional, and metabolic aspects of diabetes and hyperlipidemia. Mental development and learning capacity as affected by malnutrition (*Dr. Herrera-Acena*).

Malnutrition and cognitive development; social correlates of infant physical growth and cognitive development; poverty and the family in Latin America (*Dr. Christiansen*).

Trace mineral metabolism (*Dr. Huber*).

Anthropometric methods in the assessment of nutritional state; mathematical models of the growth of normal and malnourished humans and animals (*Dr. el Lozy*).

The epidemiology of malnutrition, physical growth deficit, and cognitive retardations (*Dr. Mora*).

The etiology of protein-calorie malnutrition in young primates, amino acid

requirements and protein quality, and the efficacy of amino acid analogs to replace their corresponding amino acids (*Dr. Samonds*).

Biochemical aspects of folic acid, vitamin B_{12}, and ascorbic acid excess, and their effects on growth, reproduction, hemopoiesis, and disease resistance; metabolic aspects of obesity and diabetes (*Dr. Thenen*).

Influence of neural factors, psychologic conditioning, and myocardial ischemia on susceptibility to ventricular arrhythmias and sudden death (*Dr. Verrier*).

Computer-based interactive dietary history, analysis, and counseling programs (*Mrs. Witschi*).

Nutrition policy formation, nutrition intervention design, and the developmental and managerial aspects of food systems within the United States and in developing countries (*Dr. Austin*).

Admission is limited and is subject to the approval of the instructor.

DEPARTMENT OF PHYSIOLOGY

James L. Whittenberger, S.B., M.D., A.M. (hon.), James Stevens Simmons Professor of Public Health, Professor of Physiology, and Head of the Department

Faculty: Professors Ferris, Hornig, Little, Mead, Peters, and Roberts; Associate Professors Amdur, Brain, Hoppin, D. E. Leith, and Sorokin; Assistant Professors Dawson, Fine, Goldman, Jaeger, Kennedy, Smith, Valberg, Wegman, and Williams; Lecturers R. Murphy, Snook, and Spencer

Teaching and Research Staff: Research Associates Boden, Bruce, J. Butler, Eisenstadt, Gold, Lewis, Nagasawa, and Ritter; Consultants McGandy and Murphy; Assistant Vetrovs

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The Department of Physiology has interests which include physiology as a basic medical science. The Department's concerns, however, extend beyond pure physiology to encompass a broad spectrum of environmental health problems. The biologic effects of air pollutants, of pesticides, and of radiation are typical problems that have been central to the Department's interests. Such broad problems require the insights of many specialties, and the personnel of the Department reflect this. The staff includes physicians, physiologists, engineers, toxicologists, and specialists in radiobiology and occupational medicine. Students and research fellows come with similarly varied backgrounds.

A major objective of the Department is to provide students with basic information on the relationship of man to his physical and chemical environment. The course Environmental Health Interdepartmental 201a, 201b introduces fundamental concepts regarding the measurement of both the quality of the environment and its impact on man. These concepts are examined in detail in specialized courses such as Principles of Toxicology and Radiation Biology. Specific research projects of members of the Department offer students an opportunity to gain experience in, and to develop a capacity for, critical evaluation of research methods. Qualified individuals may enroll in a program leading to a doctoral degree.

The research programs include topics such as cellular effects of ionizing radiation, mechanisms of carcinogenesis and mutagenesis, toxic interactions of particles and vapors, inhalation toxicology, pesticide metabolism and toxicity, comparative respiratory physiology, and the deposition and clearance of particles in the respiratory tract. Other research areas are the mechanical properties of lungs and chest wall, development of pulmonary function tests and testing equipment, and applications of these methods to the study of respiratory disease in occupational and community environments.

Physiology 203a,b. Human Physiology

Lectures, conferences, demonstrations. *Three 2-hour sessions each week. 5 units.* Dr. Leith, Staff of the Department.

Students lacking a background in biology are offered an intensive introduction to biological principles and to the physiology of cells, organ systems, and organisms. Some pathophysiology and a number of laboratory exercises are included.

Prerequisites: College courses in physics, chemistry, and mathematics, or permission of the instructor.

Physiology 205c,d. Principles of Toxicology

Lectures, laboratory demonstrations. *Two 2-hour sessions each week. 5 units.* Dr. Jaeger, Dr. Amdur.

This course deals with injurious effects of foreign chemicals. Emphasis is on basic toxicologic data leading to an understanding of such effects. History, methods, and basic principles of toxicology are discussed. Toxic chemicals are discussed in terms of damage to specific organ systems. Specific problem areas of public health, such as pesticides, air pollution, teratology, food additives, and carcinogenesis, are discussed.

Prerequisites: College chemistry and physiology. Required of students offering a major or minor concentration in toxicology.

Physiology 207c,d. Radiation Biology

Lectures. *Three 1-hour sessions each week. 4 units.* Dr. Little.

This course is divided into two parts: cellular and mammalian radiobiology. The first includes radiation chemistry; cell survival, transformation, and aging; chromosomal effects; UV-photobiology; and cellular and molecular repair processes. The second covers effects of radiation in man and characteristics of internal and external human exposure. The biologic basis of the acute radiation syndrome, and the human epidemiologic data for radiation carcinogenesis, are emphasized.

Prerequisite: Physiology 203a,b or college-level course in biology.

Physiology 208a,b,c,d. Seminar in Toxicology

Lectures, seminars. *One 1-hour session each week. 2 units (0.5 units each period).* Dr. Jaeger, Dr. Amdur.

This course consists of seminars and discussion of topics in basic research, current literature reviews, applied problem areas, and legislative matters in toxicology. Topic themes vary from year to year; students concentrating in toxicology are expected to register each year. Students who wish to offer toxicology as an area for doctoral examinations should register at least one year in this course.

Enrollment is subject to the approval of the instructor.

Physiology 209a,b. Molecular and Cellular Processes in Radiobiology

Lectures. *One 2-hour session each week.*

Laboratory. *Individual work to be arranged. 5 units.* Dr. Williams.

The effects of radiations on mammalian cells in culture are studied in detail with special emphasis on survival theory analysis, nucleic acid metabolism, synergism and antagonism between physical and chemical agents at the molecular level, and the role of molecular repair in survival. Students are given original problems in radiobiology to solve using cultured mammalian cells.

Prerequisite: Physiology 207c,d or permission of the instructor.

Physiology 210a,b. Advanced Toxicology

Lectures, discussion. *One 2-hour session each week.*

Laboratory, conferences. *4 hours each week, to be arranged. 5 units.* Dr. Jaeger, Dr. Amdur.

The purpose of this course is to provide an in-depth understanding of the biological and chemical mechanisms of action of toxic substances and an introduction to laboratory methods for research in toxicology. The course is primarily intended for students who plan careers of research in toxicology or other disciplines concerned with chemical-biological interactions.

Prerequisite: Previous completion of or concurrent registration in Physiology 205c,d, and permission of the instructor. This course will be given only if registration warrants.

Physiology 300. Tutorial Programs

Time and credit to be arranged.

Opportunities are provided for tutorial work in the fields of respiratory physiology, toxicology, occupational medicine, and radiobiology.

Physiology 350. Research

Doctoral candidates may undertake laboratory or field research under the direction of faculty members working in the following areas:

Occupational health (*Dr. Peters, Dr. Wegman, Dr. Fine*).

Radiobiology and experimental carcinogenesis (*Dr. Little, Dr. Williams, Dr. Kennedy*).

Respiratory physiology (*Dr. Mead, Dr. Leith, Dr. Hoppin, Dr. Dawson*).

Toxicology and respiratory defense mechanisms (*Dr. Amdur, Dr. Brain, Dr. Jaeger, Dr. Sorokin*).

Community air pollution (*Dr. Ferris*).

DEPARTMENT OF POPULATION SCIENCES

Joe D. Wray, A.B., M.D., M.P.H., Visiting Professor of International Health and Maternal and Child Health and Acting Head of the Department

Faculty: Professors and Visiting Professors Alonso, Dyck, Keyfitz, Levins, Lewontin, Revelle, and Salhanick; Associate Professors W. Berggren, Masnick, and Repetto; Assistant Professors G. Berggren, Ewbank, and McIntosh; Senior Lecturer Wyon; Lecturers Frisch and D. Korten

Teaching and Research Staff: Lecturers and Visiting Lecturers Guerrero, Kline, F. Korten, Morehead, Plank, and Strauss; Research Associates Holtrop, Morales, Uzgiris, and Whipple; Consultants Gamble, Goldstein, and C. Thomas

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Acting under the conviction that rapid population growth was thwarting efforts to provide better housing, education, nutrition, health services, and medical care, and that the disparity between rates of population increase and rates of development of human and economic resources is a crucial problem confronting society, the School of Public Health established the Department of Demography and Human Ecology in 1962 (renamed the Department of Population Sciences in 1969) and the Center for Population Studies in 1964. As the view of the role of population change in health and welfare has matured, increasing attention has been given to questions of the broader interrelations between population structure, health and welfare, and social change.

Faculty affiliated with the Department are specialists in demography, ethics, epidemiology, economics, sociology, ecology, genetics, business, psychology, and medicine. The formal courses and the tutorial instruction of the Department are planned to prepare students for effective participation in population programs as administrators, research workers, or educators. Programs of study are offered in the following areas: (a) population, health, and nutrition; (b) the design, management, and evaluation of population programs; (c) the analysis of complex ecological systems; (d) demographic analyses; and (e) reproductive biomedicine.

The Department participates in the School's one- and two-year Master of Science programs, the Master and Doctor of Public Health programs, and the program leading to the Doctor of Science degree. (A description of the program leading to the degree of Master of Science in Population Sciences may be found in the section entitled "Admission and Degree Requirements and Academic Programs." General descriptions of the Master of Public Health and doctoral programs are also included in that section.)

The Department Office has information on courses related to population which are available elsewhere in the University.

Population Sciences 130a,b. The American Household in Demographic Perspective (Sociology 130)

Lectures. *Two 1-hour sessions each week. 5 units.* Dr. Masnick.

This course examines, in the context of longer historical trends, the recent dramatic changes in family structure brought about by changes in patterns of household formation, marriage, separation, divorce, remarriage, childbearing, female labor force participation, and mortality. Implications for elements of the social order receive emphasis, including general integration of age structure, characteristics of the labor force, familial support in health care, and the housing market.

Population Sciences 185a,b. Applied Mathematical Demography (Sociology 185)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Keyfitz.

Topics covered by this course include probabilities of survival and of childbearing; the general one-sex model and the stable special case; parity and interbirth intervals; cohorts and periods; and extension to two sexes and to changing rates of birth and death. Also covered are application to population prediction, inferring birth rates from censuses, occupational mobility, migration, kinship, and effects of birth control.

Prerequisite: A year of calculus.

Population Sciences 190c,d. Ecology and the Spatial Distribution of Population I (Sociology 190)

Lectures, tutorials. *Two 1-hour lectures and one 1-hour tutorial session each week. 5 units.* Dr. Keyfitz, Dr. Alonso.

Topics covered by this course include the environment and its population-carrying capacity as a function of technology; limits of growth set by raw material shortages and pollution; agriculture and transport as determinants of population distribution; poles of development; territoriality, nationhood, and population growth; and the dynamics of migration.

Population Sciences 191a,b. Ecology and the Spatial Distribution of Population II (Sociology 191)

Lectures. *One 2-hour session each week. 5 units.* Dr. Alonso, Dr. Keyfitz.

This course covers urbanization in rich and poor countries, and other topics related to the territorial distribution of people and the socioeconomy, including locational forces, the problem of backward regions within rich countries, the over-urbanization debate, and housing and urban structure in poor countries. Emphasis is placed on policy issues and experiences.

Population Sciences 195c,d. The Biological Determinants of Fecundity, Environmental Factors, and Population Growth

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Frisch.

This course deals with the direct effect of environmental factors such as nutrition on population growth, through the effects on age of menarche, age of male maturation, length of adolescent subfertility, lactational amenorrhea, pregnancy wastage, and age of menopause. Contemporary and historical data on these biological factors from different cultures will be considered, as well as their interactions with social customs.

Population Sciences 200a,b. Determinants, Consequences, and Control of Population Growth

Lectures, seminars. *Two 1-hour sessions and one 2-hour seminar/laboratory session each week. 5 units.* Dr. Ewbank, Staff of the Department.

The determinants of population growth are births, deaths, and migrations. The biosocial forces regulating each of these are examined, and the consequences of continued rapid population increase and alternative projections are considered. The physiology of reproduction is reviewed and methods and programs for its control are evaluated. The ethical and policy issues of population growth are discussed. Concepts are illustrated by historical and current references. A term paper is required.

Population Sciences 201a,b. Determinants, Consequences, and Control of Population Growth

Lectures. *Two 1-hour sessions each week. 2.5 units.* Dr. Ewbank, Staff of the Department.

This course consists of the lecture series for Population Sciences 200a,b. It is intended only for those students who are not concentrating in the Department of Population Sciences and who are unable to fit the full course (200a,b) into their schedules.

Population Sciences 202c,d. Departmental Seminar

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wyon, Staff of the Department.

This course is oriented towards health and population problems of communities. Each student selects a community and an appropriate health or population problem. He presents a critical survey of the relevant literature and a project design, to amplify understanding of the relative frequency of the selected problem in relation to other health or population problems of the community, and to increase or test the available knowledge of causes of the problem.

Population Sciences 203c,d. Demographic Methods

Lectures. *Two 2-hour sessions each week.*

Laboratory. *2 hours each week. 5 units.* Dr. Ewbank, Dr. Masnick.

This course examines methods of measuring mortality, fertility, and migration, projecting future populations, and evaluating the quality of published demographic data and projections. Students may choose to specialize in analysis of demographic structure of more developed or less developed countries or problems of analysis of national or local populations.

Population Sciences 204c,d. Biological Basis for Fertility Control

Lectures. *Two 1-hour sessions each week, with a third hour at the discretion of the instructor.*

Laboratory. *Six 2-hour sessions, to be arranged. 5 units.* Dr. Salhanick, Staff of the Department.

This course presents the fundamental physiology and biochemistry related to known and potential methods of family planning. Topics covered include the biosynthesis, secretion, effects, and modes of action of the gonadal and gonadotropic hormones; the relationship of the natural steroid hormones to synthetic analogues is also discussed. Laboratory sessions include demonstrations of a family planning clinic, an infertility unit, and procedures for sterilization and pregnancy termination.

Prerequisites: Population Sciences 200a,b and appropriate science background.

Population Sciences 205c,d. Readings in Population Studies

Seminars. *One 1½-hour session each week. 2.5 units.* Staff of the Department.

This course is an introduction to the literature pertaining to population theory, research, and fertility control programs. It is offered for students concentrating in the Department. Seminar discussions are directed toward the analysis and evaluation of the assigned selections.

Population Sciences and Health Services Administration 207c,d. The Design and Management of Population Programs

Case discussions, seminars. *Two 2-hour sessions each week. 5 units.* Dr. D. Korten, Dr. F. Korten, Dr. Wyon, Staff of the Department.

This course addresses, from a managerial perspective, the problems of developing and implementing population programs in Third World nations. These problems are examined from the level of the community, the program manager, and the national development planner. Topics are covered primarily through case studies based on family planning, health, nutrition, and rural development programs. Stress is placed on programs involving rural community members in program implementation.

Enrollment is subject to the approval of the instructors. Preference is given to persons with Third World experience and professional commitment to Third World social development.

Population Sciences 208a,b. Population and Disequilibrium in Developing Countries (Sociology 280)

Seminars. *One 2-hour session each week. 5 units.* Dr. Keyfitz, Dr. Revelle. Not given in 1977-78.

Seminars deal with the interactions of population change, rural development, and urbanization in developing countries. Faculty and students compare approaches as applied to models of population equilibrium at the levels of the family, village, and larger regions, and study the process of disequilibrium caused by migration, mortality, technology, and human aspirations. Students present team term papers and at least one seminar.

Enrollment is subject to approval of the instructor.

Population Sciences 211e. Evaluation and Management of the Infertile Couple

Lectures, field visits. *Daily lectures during the one-week reading period between fall and spring terms. 1 unit.* Dr. McIntosh, Staff.

Primarily intended for students who will be working in family planning programs, this course deals with the evaluation and management of the infertile couple and the desirability of providing infertility services in family planning programs. The organization and operation of an infertility unit and methods for describing the population evaluated are discussed. Films of specific diagnostic procedures and a visit to the Fertility and Endocrine Unit at the Boston Hospital for Women are included.

Prerequisites: Population Sciences 200a,b and medical science background. Enrollment is limited and is subject to the approval of the instructor.

Population Sciences 212c,d. An Economic Approach to Population Policy

Lectures. *One 2-hour session each week, with a third hour at the discretion of the instructor. 5 units.* Dr. Repetto.

This course presents the economics relevant to the formulation and evaluation of population policies in developing countries and surveys knowledge about the effectiveness of intervention strategies. It covers welfare economics of population policies; interactions between fertility and economic development; the impact on population growth of policies to affect incomes, education, survivorship, old-age security, and related variables, as well as conventional family planning programs.

Prerequisites: Population Sciences 200a,b and Interdepartmental 210a,b, or equivalent.

Population Sciences 216c,d. Comparative Analysis of Public Policies in Developing Countries (Government 211)

Lectures. *One 2-hour session each week. 5 units.* Dr. John Montgomery (Professor of Public Administration), Dr. Joel Migdal (Associate Professor of Government).

This course examines patterns of policy making across cultures and issue areas, including interactions between policies and social contexts. It surveys Third World policies for dealing with such problems as population (fertility and migration); malnutrition; land reform; and management of large-scale irrigation systems. It applies the policy sciences approach to the formulation and implementation of large-scale programs of public intervention in social processes.

Population Sciences 285c,d. Applied Mathematical Demography Seminar (Sociology 285)

Seminars. *One 2-hour session each week. 5 units.* Dr. Keyfitz.

This course consists of research on the topics of Population Sciences 185a,b.

Enrollment is subject to approval of the instructor.

Population Sciences 286c,d. Formal Models of Movement (Sociology 235)

Seminars. *One 2-hour session each week; additional individual consultations to be arranged. 5 units.* Dr. Alonso.

This course reviews a broad variety of models of movement of populations and other types of movement, from the social sciences and possibly from the natural sciences. A detailed examination of the structure, assumptions, and uses of these models is presented. An effort is made to place them within a common theoretical structure and to compare their assumptions and implications.

Population Sciences 300. Tutorial Programs

Time and credit to be arranged.

Students at the master's level may make arrangements for tutorial work and special reading on topics related to population problems. There may be an opportunity to consider the design of studies, programs, or analysis of data.

Population Sciences 330e. Field Visits

One-week period between fall and spring terms or one-week period between third and fourth quarters. 1 unit.

Students concentrating in the Department of Population Sciences may participate in visits to organizations currently active in demographic studies, community education, and research and service in fertility control.

Additional Field Study

At the end of the academic year, a field visit may be arranged for students majoring in the Department of Population Sciences.

Participation is limited to 10 students.

Population Sciences 350-357. Research

Time and credit to be arranged.

Candidates for doctoral degrees may undertake research in the Department or may integrate research in population sciences with a doctoral program in another department or at the Center for Population Studies.

Members of the Department and of the Center for Population Studies are currently engaged in research in the following areas:

350 Topics in field studies and programs (*Dr. Wyon, Dr. Plank, Dr. Guerrero, Dr. Berggren*).

351 Topics in biomedicine and reproductive physiology (*Dr. Salhanick, Dr. McIntosh*).

352 Topics in demography (*Dr. Keyfitz*).

353 Topics in population ethics (*Dr. Dyck, Dr. Potter*).

354 Topics in population policy (*Dr. Revelle*).

355 Topics in population economics (*Dr. Repetto*).

356 Topics in population and resource interaction (Center for Population Studies) (*Dr. Revelle, Dr. Thomas, Dr. Rogers*).

357 Topics in complex systems (*Dr. Levins*).

DEPARTMENT OF SANITARY ENGINEERING

Harold A. Thomas, Jr., S.B., S.M., S.D., Gordon McKay Professor of Civil and Sanitary Engineering

J. Carrell Morris, S.B., A.M., Ph.D., A.M. (hon.), Gordon McKay Professor of Sanitary Chemistry

Joseph J. Harrington, B.C.E., A.M., Ph.D., Professor of Environmental Health Engineering in the Faculty of Public Health and Gordon McKay Professor of Environmental Engineering in the Faculty of Arts and Sciences

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The courses in which members of this Department participate in the School of Public Health are listed on page 68 (Environmental Health Interdepartmental 201a, 201b) and on page 58 (Interdepartmental 215c,d).

The courses of instruction listed below are offered in the Division of Applied Sciences of the Graduate School of Arts and Sciences. Graduates of engineering colleges or scientific schools may be admitted to the Division as candidates for the degree of Master of Science or Doctor of Philosophy. They may elect appropriate courses in the School of Public Health as part of the program for these degrees. Further information can be obtained by writing to the Committee on Admissions, Graduate School of Arts and Sciences, Holyoke Center, 75 Mt. Auburn Street, Cambridge, Massachusetts 02138.

The following courses offered in the Division are open to properly qualified students from the School of Public Health:

Engineering Sciences 171. Chemistry of the Aqueous Environment

Half course (*fall term*). *M., W., F., at 11.* Professor Butler.

To be given in 1978-79.

Chemical principles applicable to environmental science and engineering. pH, complex formation, and solubility in multicomponent systems. Principles of analytical chemistry and their application to analysis of water. Sources, occurrence, and chemical reactions of important constituents in natural waters.

Prerequisite: Chemistry 10 or equivalent.

Engineering Sciences 173. Introduction to Environmental Microbiology

Half course (*spring term*). *M., W., F., at 9, and laboratory hours to be arranged.* Dr. Ducklow.

Introduction to microbiology. Emphasis on microbial ecology. Application to problems in water pollution.

Prerequisite: Biology 2 or equivalent.

Engineering 250a. Design of Water Resource Systems

Half course (*fall term*). *Hours to be arranged.* Professor Thomas.

Principles of engineering and economic analysis applied to water resource systems. Functional design of comprehensive management systems for collection, storage, conveyance, treatment, and distribution of water. Uses techniques of operations research and econometrics to develop methods for planning integrated systems of dams, reservoirs, canals, pipelines and networks, pumps, and treatment plants.

Prerequisites: Applied Mathematics 105a; Engineering Sciences 121, 123 or equivalents.

Engineering 250b. Design of Water Resource Systems

Half course (*spring term*). *Hours to be arranged.* Professor Thomas.

Continuation of Engineering 250a, with emphasis on nonlinear systems and systems with stochastic components. Application to multiunit systems for industrial, municipal, and agricultural water supply, navigation, hydropower, conservation of wildlife, and the preservation and enhancement of the environment.

Prerequisite: Engineering 250a. Statistics 190 or equivalent desirable.

Engineering 251. Water Resources Design Practice

Half course (*spring term*). *Hours to be arranged.* Professor Fiering.

Emphasizes engineering considerations required to design selected components of water-resource systems. Whereas other courses in this area stress planning and optimization procedures, this course focuses on translation from model studies to design specifications. Each student performs a complete design exercise, including assembly of data, interaction with agency officials, budgeting, and dimensioned sketches. Written and oral presentation required.

Engineering 253. Stochastic Processes

Half course (*fall term*). *M., W., F., at 9.* Professor Fiering.

To be given in 1978-79.

Theory and applications of stochastic processes and time series for environmental problems, including hydrology, birth-death processes, hazard perception, storage systems, queues, Markov chains, multivariate techniques, and spectral analysis.

Prerequisites: Engineering 250a, Engineering Sciences 118, or equivalents.

Engineering 254. Mathematical Programming for Large Systems

Half course (*fall term*). *M., W., F., at 9.* Professor Rogers.

Application of optimizing theory to large environmental control systems. Practical problems involved in formulation and computation of mathematical programming models for these systems. Decomposition, multi-level

and multi-objective planning, stochastic and mixed integer programming models.

Prerequisite: Engineering Sciences 119 or equivalent.

Engineering 257. Seminar: Models for Environmental Systems Planning

Half course (*throughout the year*). *Hours to be arranged.* Professors Fiering, Harrington, Rogers, and Thomas.

Critical evaluation of current systems applications in environmental science, with emphasis on models for the analysis of standards, optimality, and resilience in water-resource systems. Papers and presentations are required.

Engineering 270. Engineering Systems for Environmental Control

Half course (*spring term*). *M., W., F., at 10.* Professor Harrington.

Provision of urban water; engineering aspects of the collection and disposal of spent water and solid wastes; significant interchanges between the gaseous, liquid, and solid phases of the environment; geographic interchanges; time-dependent developments. Data collection and processing for monitoring and control; maintenance and operation of pollution control systems.

Prerequisite: Engineering Sciences 123 or equivalent.

Engineering 272. Water Quality and Its Management

Half course (*spring term*). *Tu., Th., 11-12:30.* Professor Morris.

To be given in 1978-79.

Nature, sources, and effects of inorganic and organic impurities in natural waters. Water quality standards. Effects of contaminating and polluting discharges on water quality. Natural purification of surface waters. Chemical and biochemical transformations in lakes and rivers.

Prerequisites: Engineering Sciences 171 and 173.

Engineering 273. Water Pollution Microbiology

Half course (*fall term*). *M., F., 2-3:30.* Professor Mitchell.

To be given in 1978-79.

Advanced discussion of the role of microorganisms as both pollutants and purifying agents. Particular attention to ecological approaches to pollution control. Eutrophication, microbial imbalances, pesticides, stream purification, and a critical discussion of current waste treatment methods.

Prerequisite: Engineering Sciences 173 or equivalent.

Engineering 274. Chemical Models of Natural and Polluted Waters

Half course (*spring term*). *Tu., 1-4.* Professor Butler.

To be given in 1978-79.

Chemical aspects of aqueous environmental systems. Mathematical

models include thermodynamic, kinetic, biological, and hydrodynamic processes. Applications to water quality management, pollution control, limnology, oceanography, and geology.

Prerequisites: Physical chemistry (e.g., Engineering Sciences 171) and some experience in computer programming.

Engineering 276. Treatment of Water Supplies and Wastewaters

Half course (*spring term*). *Tu., Th., 11-12:30.* Professor Morris.

Quality standards for water supplies. Processing of water for municipal use, including coagulation, softening, deferrization, disinfection, adsorption, and demineralization. Physical, chemical, and biological treatment of wastewaters, including "advanced" methods.

Prerequisite: Engineering Sciences 171 or permission of instructor.

Engineering 278. Rate Processes

Half course (*fall term*). *M., W., F., at 11.* Professor Morris.

Kinetics of physical and chemical reactions, with emphasis on aqueous systems. Kinetic data and their interpretation. Mechanisms of inorganic reactions. Reaction dynamics in environmental engineering.

Prerequisite: Engineering Sciences 171 or equivalent.

DEPARTMENT OF TROPICAL PUBLIC HEALTH

Thomas H. Weller, A.B., S.M., M.D., LL.D., Richard Pearson Strong Professor of Tropical Public Health, Director of the Center for the Prevention of Infectious Diseases, and Head of the Department

Faculty: Professor Chernin; Associate Professors W. Berggren, Michelson, Pan, and Spielman; Assistant Professors Boyer, Coolidge, Hoff, Hopkins, Mott, and Waner; Lecturer Daggy

Teaching and Research Staff: Visiting Lecturers Fendall, Kaiser, Mata, Moschella, Most, Neva, Popenoe, Scrimshaw, and Sencer; Research Associate Cicconi; Assistant Wheeldon

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The health problems of the tropical regions, as in all poorly sanitated areas, are predominantly of an infectious and nutritional nature. The infectious diseases are the primary concern of the Department of Tropical Public Health, with emphasis given to protozoal, helminthic, and viral entities and to relevant arthropod and molluscan intermediate hosts. Within the framework of the Center for the Prevention of Infectious Diseases, the Department of Tropical Public Health shares with the Department of Microbiology the responsibility for an integrated presentation of information on important infectious agents.

Therefore, the basic course, Tropical Public Health and Microbiology 201a,b, is designed to provide students in the Master of Public Health program with knowledge regarding major infectious diseases, and with factual information concerning the epidemiology and control of selected entities of public health importance.

The resolution of the health problems of tropical areas requires a multidisciplinary approach involving a considered appraisal of human resources as well as of relevant social, economic, and political factors. Thus, the student concentrating in the Department in preparation for a career in the field of international health should, in addition to departmental courses, acquire a broadened experience by elective work in other areas.

The investigative program in the Department currently deals with pathogens ranging from viruses to helminths. Studies on the *in vitro* cultivation and the physiology and immunology of a wide variety of agents are in progress. Biological investigations on the molluscan vectors of the schistosomes comprise another area of major interest. Facilities are available for the training of a limited number of students at the Doctor of Public Health or Doctor of Science level. The doctoral degree applicant should, if possible, obtain the necessary medical science background prior to enrollment. Collaborative arrangements established with institutions in the tropics provide diversified opportunities for study and research overseas.

Tropical Public Health and Microbiology 201a,b. Ecology and Epidemiology of Infectious Diseases

Lectures, seminars, demonstrations; laboratory elective. *Four 1-hour sessions and one 2-hour elective laboratory session each week, first period; one 1-hour session and two 2-hour sessions each week, second period. 5 units; 6 units if laboratory elected.* Dr. Weller, Dr. Nichols, Staffs of the Departments.

The communicable diseases of major public health importance are considered on an integrated basis. Discussions encompass the status of infectious diseases in developing and developed countries, and the rationale of selecting procedures for disease control. A knowledge of the pathogenesis of disease produced by infectious agents is desirable.

Microbiology and Tropical Public Health 202b. Critiques of Current Literature on Infectious Diseases

Seminars. *One 2-hour session each week. 1 unit.* Dr. Chernin, Dr. Herrmann, Staffs of the Departments.

(Course is described under Department of Microbiology.)

Tropical Public Health 203d. Perspectives in Tropical Health

Lectures, conferences. *One 2-hour session each week. 1 unit.* Dr. Weller, Guest Lecturers.

This course provides background information on environmental, social, economic, and political factors that influence health programs in the tropics. At each session a distinguished guest lecturer covers an assigned topic, including such subjects as the development of professional education, problems of agriculture, nutrition, and water supply, and the political background of international cooperation. Each presentation is followed by informal student discussion. Enrollment is open to all students.

Tropical Public Health 204c. Laboratory Aspects of Parasitic Diseases

Lectures, seminars, laboratory exercises. *Two 3-hour sessions each week. 2.5 units.* Dr. Pan, Dr. Coolidge.

This course emphasizes laboratory methods for the study of parasitic diseases of public health importance. Students are exposed to the theory and application of techniques essential to epidemiologic and laboratory investigation. The life cycles of several parasites are maintained and examined with respect to detection and quantification of infection, immunity, and control.

Enrollment is limited and is subject to the approval of the instructor.

Tropical Public Health 205c. Clinical and Pathologic Features of Tropical Diseases

Case presentations, clinico-pathologic conferences, demonstrations.

One 2-hour session each week. 1 unit. Dr. Weller, Dr. Hopkins, Dr. Coolidge, Dr. Boyer, Dr. Franz von Lichtenberg (Professor of Pathology, Harvard Medical School), Staff of the Department.

This course, designed for students particularly interested in tropical medicine, supplements material presented in Tropical Public Health and Microbiology 201a,b. The emphasis is on the clinico-pathologic aspects of tropical diseases. At each session disease entities are introduced by presenting a clinical case, and pertinent clinical and pathologic features of the disease are then reviewed.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 207d. Introduction to Molluscs of Public Health Importance

Conferences, laboratory and field exercises. *One 3-hour session each week. 2 units.* Dr. Michelson.

To be given in 1978-79; alternates yearly with Tropical Public Health 208d.

This is an introductory course designed to acquaint the student with the molluscs which may act either as active or passive agents for the dispersal of pathogens, toxins, or parasites which cause disease in man. Special emphasis is given to snails which serve as intermediate hosts of mammalian schistosomes. Students may study field and laboratory techniques necessary for an understanding of the taxonomy, morphology, cultivation, ecology, and control of these medically important molluscs.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 208d. Epidemiology and Control of Schistosomiasis

Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Michelson, Dr. Chernin, Dr. Pan, Dr. Weller.

To be given in 1977-78; alternates yearly with Tropical Public Health 207d.

The problems posed by schistosomiasis as an expanding health hazard are presented in a series of seminars and laboratory exercises. Emphasis is given to the biology of snail vectors, to problems of assessment of significance of the disease, and to the potentials of various approaches to control. Opportunity to become familiar with appropriate techniques is afforded in the laboratory.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 209d. Introduction to Medical Entomology

Conferences, laboratory, field exercises. *One 3-hour session each week. 2 units.* Dr. Spielman.

To be given in 1977-78; alternates yearly with Tropical Public Health 210d.

This course deals with the insects, ticks, and mites of public health importance. The manner in which arthropods transmit disease and the principles of vector control are discussed from ecological, physiological, and

genetic points of view. Colonies of various vector species are maintained by the students to provide the basic material for study of life cycles and for arthropod identification. Laboratory and field exercises demonstrate entomological techniques currently employed by epidemiologists.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 210d. Current Problems in Malariology

Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Chernin, Dr. Spielman, Dr. Weller, Staff of the Department.

To be given in 1978-79; alternates yearly with Tropical Public Health 209d. This course supplements the subject material on malaria offered in Tropical Public Health and Microbiology 201a,b and Tropical Public Health 204c. Particular attention is given to problems now encountered in eradication and control programs. In the laboratory, experience is provided with procedures essential to the epidemiologic investigation of malaria.

Enrollment is subject to the approval of the instructor.

Tropical Public Health and Microbiology 214c,d. Case Studies in Epidemiology of Infectious Disease

Seminars, laboratory exercises. *One 2-hour session each week. 2.5 units.* Dr. Hopkins, Dr. Nichols.

This course deals with problems in the epidemiology of communicable and other acute diseases. In each session a case study is taken from an actual epidemic or other acute disease control situation, and the student is asked to assume the role of investigator and control officer. An introductory biostatistics course or equivalent is suggested as preparation for the course.

Microbiology and Tropical Public Health 216d. Sexually Transmitted Diseases

Lectures, seminars. *One 2-hour session each week. 1 unit. Additional credit may be arranged.* Dr. Hopkins, Dr. Nichols, Guest Lecturers.

(Course is described under Department of Microbiology.)

Microbiology and Tropical Public Health 217d. Virology

Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner.

(Course is described under Department of Microbiology.)

Tropical Public Health 300a,b,c,d,e. Tutorial Programs

Laboratory exercises. *Time and credit to be arranged.*

Individual work for candidates at the master's degree level may be carried out under supervision of a member of the Department. Various parasites of medical importance are maintained and are available for studies on

metabolism, host-parasite relationships, and chemotherapy. Arrangements are subject to the approval of the instructor.

Tropical Public Health 350. Research

Doctoral candidates or qualified full-time special students may undertake original investigations in the laboratory or in the field by arrangement with the Head of the Department.

Members of the Department are currently engaged in the following areas of research:

351 Tissue culture and immunological techniques as applied to problems in medical virology (*Dr. Weller, Dr. Waner*).

352 Cultivation *in vitro* of parasitic helminths, protozoa, and other invertebrates of medical importance (*Dr. Weller, Dr. Chernin, Dr. Pan*).

353 Biology, host-parasite relationships, and control of molluscan vectors of schistosomiasis and of other parasitic infections (*Dr. Chernin, Dr. Michelson, Dr. Pan*).

354 Population genetics, nutrition, and reproduction of medically important arthropods (*Dr. Spielman*).

355 Arthropod transmission of viral, protozoan, and helminthic agents (*Dr. Spielman*).

356 Immunology of yaws and syphilis (*Dr. Hopkins*).

357 Immunology of schistosomiasis (*Dr. Boyer, Dr. Weller*).

358 Epidemiology of Chagas' disease and schistosomiasis in rural Brazil (*Dr. Mott, Dr. Hoff*).

359 Mechanisms of health care in rural Haiti (*Dr. Berggren*).

Officers of Instruction and Research

MEMBERS OF THE FACULTY

William Alonso, Ph.D., Richard Saltonstall Professor of Population Policy; *Director of the Center for Population Studies.*

Mary Ochsenhirt Amdur, Ph.D., Associate Professor of Toxicology (*Physiology*).

Harry Nicholas Antoniades, Ph.D., Associate Professor of Biochemistry (*Nutrition*); *Senior Investigator, Blood Research Institute, Inc., Boston.*

James Edward Austin, D.B.A., Lecturer on Nutrition Planning and Policy (*Nutrition*); *Associate Professor of Business Administration, Harvard Business School.*

John Christian Bailar, III, M.D., Ph.D., Visiting Professor of Biostatistics; *Editor-in-Chief, Journal of the National Cancer Institute, NIH, Bethesda, MD.*

Colin Banks Begg, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

Robert Charles Benfari, M.B.A., Ph.D., S.M. in Hyg., Associate Professor of Psychology (*Behavioral Sciences*).

Gretchen Mary Berggren, M.D., S.M. in Hyg., Assistant Professor of Population Sciences.

Warren Lee Berggren, M.D., Dr.P.H., Associate Professor of Tropical Public Health and Population Sciences.

Ralph Edward Berry, Jr., Ph.D., Professor of Economics (*Health Services*).

Robert Henry Binstock, Ph.D., Visiting Professor of Health Services; *The Louis Stulberg Professor of Law and Politics, Brandeis University.*

Yvonne Millicent Mahala Bishop, Ph.D., Associate Professor of Biostatistics.

Bengt Erik Bjarngard, D.Sc., Lecturer on Medical Radiation Physics (*Environmental Health Sciences*); *Associate Professor of Radiation Therapy, Harvard Medical School.*

Markley Holmes Boyer, M.D., D.Phil., M.P.H., Assistant Professor of Tropical Public Health.

Joseph David Brain, S.D. in Hyg., Associate Professor of Physiology; Acting Associate Dean for Academic Affairs.

Peter Braun, M.D., Lecturer on Public Health (*Health Services*).

William Alfred Burgess, S.M., Associate Professor of Occupational Health Engineering (*Environmental Health Sciences*).

Jan Cerny, M.D., Ph.D., Associate Professor of Immunology (*Microbiology*).

Gordon Chase, A.B., Lecturer on Health Policy.

Eli Chernin, S.D., Professor of Tropical Public Health.

Niels Edward Christiansen, Ph.D., Assistant Professor of Sociology (*Nutrition*).

Philip Timothy Cole, M.D., Dr.P.H., Associate Professor of Epidemiology (on leave 77-78).

Catherine Coolidge, M.D., M.P.H., Assistant Professor of Tropical Public Health.

Douglas Winslow Cooper, Ph.D., Assistant Professor of Environmental Physics (*Environmental Health Sciences*).

William George Costello, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

Allen Latham Cudworth, S.M. in E.E., S.D. in Hyg., Lecturer on Applied Acoustics and Environmental Health (*Environmental Health Sciences*); *Vice President of Liberty Mutual Insurance Company and Director, Hopkinton Research Center.*

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Robert Curtis Ellison, M.D., S.M. in Epid., Lecturer on Epidemiology; *Associate Professor of Pediatrics, Harvard Medical School.*

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William Edward McAuliffe, Ph.D., Associate Professor of Sociology (*Behavioral Sciences*).

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Jere Mead, M.D., Cecil K. and Philip Drinker Professor of Environmental Physiology (*Physiology*).

Charles Marie Joseph Mertens de Wilmers, M.D., Lic. en Psych., Visiting Professor of Psychiatry (*Behavioral Sciences*); *Professor of Medical Psychology, Faculty of Medicine, Catholic University of Louvain, Belgium.*

Edward Harlan Michelson, Ph.D., Associate Professor of Tropical Public Health.

William Leonard Mietlowski, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute* (from Jan. 1, 1978).

Ollí Sakari Miettinen, M.D., M.P.H., Ph.D., Professor of Epidemiology and Biostatistics.

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Charles Frederick Mosteller, Ph.D., Professor of Mathematical Statistics (*Biostatistics*); *Member of the Faculty of Medicine, Harvard Medical School.*

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Peter Alexander Valberg, Ph.D., Assistant Professor of Physiology.

Richard Leonard Verrier, Ph.D., Assistant Professor of Physiology (*Nutrition*).

John William Vinson, S.D. in Hyg., Associate Professor of Microbiology.

Warren Ernest Clyde Wacker, M.D., Henry K. Oliver Professor of Hygiene; *Director of University Health Services.*

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THE TEACHING STAFF

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Elliott Leo Atamian, D.B.A., Lecturer on Health Services Administration.
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Amy Claire Barkin, M.S.W., M.P.H., Visiting Lecturer on Health Services.
Diana Barrett, S.M., M.B.A., Instructor in Management (*Health Services*).
James Elmer Barrett, Jr., M.D., Visiting Lecturer on Social Psychiatry (*Behavioral Sciences*).
Madeline Ann Poynter Bauer, Ph.D., Lecturer on Biostatistics.
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Arthur Angelo Berarducci, M.P.H., Lecturer on Health Services Administration.
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Helen Dorothy Cohn, M.P.H., Lecturer on Public Health Nursing (*Health Services*).
Jeanne Ann Coombs, Dr.P.H., Lecturer on Health Education (*Health Services*).
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John Kenneth Dane, LL.B., LL.M., Visiting Lecturer on Workmen's Compensation (*Environmental Health Sciences*).
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David Hemenway, Ph.D., Lecturer on Health Services Administration.
Christine Lee Hobart, D.B.A., Visiting Lecturer on Labor Relations (*Health Services*).
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Carl Norman Wathne, S.M., Visiting Lecturer on Health Services.
Leon Seligsberger White, Ph.D., Lecturer on Health Services.
George Green Wright, Ph.D., Visiting Lecturer on Applied Microbiology.
Grace Wyshak, Ph.D., Visiting Lecturer on Biostatistics and Epidemiology.
Alfred Yankauer, M.D., M.P.H., Visiting Lecturer on Health Services.
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Ruth Margaret Butler, S.M., Research Associate in Social Work (*Health Services*).
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Shu-heh Wang Chu, Ph.D., Research Associate in Nutrition.
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